TDS-90-09

Cost-effectiveness of Climbing Lanes: User's Manual

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Documentation Page

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Cost-effectiveness of Climbing Lanes: User's Manual

Author(s): A. M. Khan - Principal Investigator, Carleton University
N. M. Holtz - Investigator, Carleton University

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Contact Person: Ataur Bacchus, Project Manager, Highway Innovation and Strategic Research Office (416) 235-4673;
Alex Ugge, Pavements and Roadway Office (416) 235- 4698

Abstract: The CECL Program is an interactive, screen-oriented, menu-driven PC-based software package for the analysis of the effect of adding climbing lanes to selected locations along two-lane rural highways. The main analysis functions are: (a) choosing the start and end locations of the climbing lane based on the speed differential of a heavily loaded truck; (b) predicting the effects on level of service and average speed of adding a climbing lane; (c) performing a cost- effectiveness analysis based on reduction of delay and reduction in accidents. CECL provides extensive on-line help for the novice or inexperienced user, and is menu-driven for ease of use.

The User's Manual provides installation instructions for the CECL program, an overview of program usage, documentation for minor customization, and a worked example. Also provided is a reference guide detailing all aspects of program use.

Comments: User's manual for CECL computer program. Programmer's manual (TDS-90-10) also available. Part of final report of Research and Development Project 25193.

Key Words: climbing lanes, grade, two-lane road, speed-distance, cost-effectiveness, computer program, user documentation

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Cost-effectiveness of Climbing Lanes: User's Manual

A. M. Khan
Principal Investigator

N. M. Holtz
Investigator

Carleton University

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For additional copies, contact:
The Editor, Technical Publications
Room 320, Central Building
1201 Wilson Avenue
Downsview, Ontario
Canada M3M 1J8

Telephone: (416) 235-3480
Fax: (416) 235-4872

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Preface

Program CECL[1] is an interactive, screen-oriented PC-based software package for the analysis of the effect of adding climbing lanes to selected locations along two-lane rural highways. Analyses includes:

- choosing the start and end locations of the climbing lane based on the speed differential of a heavily loaded truck.
- the effects on level of service and average speed when a climbing lane is added.
- cost effectiveness analysis based on reduction of delay and reduction in accidents.

Chapter 1 provides installation instructions (for installing the software from the distribution diskettes to a hard disk).
Chapter 2 provides a brief overview of running the software.

CECL was developed by the authors at the Department of Civil Engineering, Carleton University, Ottawa, Ontario under contract for Project Number 25193, Ministry of Transportation, Province of Ontario.

This version of the manual corresponds to CECL program version 1.13, dated September 5, 1990. See Section 1.6 for a description of how version 1.13 differs from previous versions.
See Chapter 5 for a list of some of the known problems in version 1.13.

[1] CECL is pronounced "Cecil"

Part I

User's Guide

1 Installation

1.1 System Requirements

- IBM PC[1] or compatible computer.
- 640 KB memory.
- PC-DOS[2] or MS-DOS[3] Version 3.0 or higher.
- A hard disk with at least 1800 Kbytes of free space (if this is a new CECL installation; installing over an older version of CECL replaces many files so that much less free space is required).
- Graphics card and monitor compatible with Hercules[4], CGA, EGA or VGA.

1.2 Installation Concepts

The installation procedure assumes the existence of a CECL "root" directory on the target hard disk drive. In this chapter, the root directory will be referred to as "`C:\CECL`", but in fact it can be any directory on any drive. The installation procedure prompts for both drive and root directory, and attempts to create the root directory if it does not already exist. Note that the creation may fail if the name is invalid for some reason, or if a file by that name already exists, or if some higher level directories in the root path name do *not* exist.

The installation procedure copies the executable programs, the help data base, the configuration file, and a number of other files to the root di-

[1] IBM is a trademark of International Business Machines Corp.
[2] PC-DOS is a trademark of International Business Machines Corp.
[3] MS-DOS is a trademark of Microsoft Corp.
[4] Hercules is a trademark of the company that has registered "Hercules", whoever that is.

rectory. It also creates a number of sub-directories under the root directory, and copies various files into them.

1.2.1 The Configuration File

During normal operation, CECL requires access to a number of data files. A configuration file, "`cecl.cfg`", provides the names and locations of these files, as well as a providing a number of other defaults and values for CECL's use. See section 3.2 for more information about the parameters given in the configuration file.

The installation procedure modifies this configuration file and installs it in the main CECL root directory. It is modified to reflect the locations of the other files as installed, so that manual modification of this file is almost never required.

During execution of CECL, the configuration file itself is located by searching in the same directory as the CECL executables. Once this file is located and loaded, variables in the configuration file specify the locations of other important files.

Different configuration files may be specified; see section 3.1 for more information.

1.3 Installation Instructions

The following instructions assume installation of all the software into a root directory called `CECL` on drive `C:`, with installation coming from floppies in drive `A:`. If you wish to install into a different root directory, or onto a different hard drive, or to use a different floppy drive as the source, substitute the appropriate names in the commands listed below.

1. Make drive `C:` the current drive. This is the drive onto which the CECL software will be installed:

   ```
   C:
   ```

2. Create a `\CECL` root directory to receive the software:

   ```
   MKDIR \CECL
   ```

3. Make that newly created directory the current directory:

   ```
   CD \CECL
   ```

4. Place the floppy labelled **CECL INSTALL** in floppy drive **A:**

5. Start the installation procedure, specifying drive **A:** as the source drive:

```
A:INSTALL A:
```

6. Answer the questions and replace the floppy disks as asked. (See Section 1.5, below, for explanation of the questions asked during installation).

7. Modify your **AUTOEXEC.BAT** file to add **C:\CECL** to the DOS search path. Alternatively, run the program with the command:

```
C:\CECL\CECL
```

First time users must read "Getting Started", Chapter 2.

1.4 Installation Notes

1. See the file **READ.ME** in the installed CECL directory for last minute changes and warnings.

2. It is strongly recommended that you do *not* run **CECL** with the root directory, **C:\CECL**, as the current working directory. As long as **C:\CECL** is on the DOS command search PATH, or as long as you use an explicit path name to start it executing, it can be run from any drive and/or directory.

1.5 Installation Messages

The following questions and prompts may be issued during the installation procedure. Where a prompt has a default response, it is shown in square brackets ([...]) after the question. Simply hitting the "Enter" key will result in the default being used.

• CECL must be installed on a hard disk with at least *nnnn* Kbytes of free space.

Simply informs you that a new CECL installation will require about *nnnn* free KBytes of disk storage; installation over an older version will

take considerably less as it will re-use the space occupied by the old version. Requires no response.

- **Drive on which to install CECL (A - F) [*C:*]**
  Requests that you supply the name of a hard disk drive onto which the CECL software will be installed.

- **Enter directory on drive *C:* in which to install CECL: [*path*]**
  Requests that you supply the name of the root directory on the indicated drive. This will be the root directory for CECL.

- **Installing CECL from drive *A:* to directory *d:dir*. OK ?**
  Simply asks you to confirm, with a "Y" or "N", that the source drive and destination drive and directory given earlier are correct.

- **Free disk space = *nnnn*K, Reqd = *mmmm*K. Continue ?**
  The install program has determined that the specified hard drive does not have a sufficient amount of free disk space to hold the entire CECL installation. If this is a new installation, it will likely fail if you continue, so you should stop, delete some files, and try the installation again. If you are installing a new version of CECL to replace an older version in the same root directory, then the installation will likely be successful. Answer "Y" to proceed with the installation, "N" to abort.

- **Insert floppy disk labelled "*zzzz*" in drive *A:***
  The installation program requires a new floppy disk in the source drive. Replace the disk with the one indicated, and strike any key.

- **Replace existing configuration file "cecl.cfg" ?**
  You are installing a new version of CECL to replace an existing, older version. If you have made modifications to the configuration file, and answer "Yes" to this question, you will lose those modifications. On the other hand, if you answer "No", you will not get a new version of the configuration file that might be required by CECL. You should probably answer "Yes", and re-edit **cecl.cfg** to make the same modifications (if any).

- **Terminate installation ?**
  You have type "Ctrl-C" or "Ctrl-Break" to interrupt the the installation program. This is just asking you if you really want to abort the installation.

- **The disk in drive *A:* does not seem to be the correct disk.**
  You were prompted to install a disk in the source floppy drive, but the one you inserted does not seem to be the one asked for. Check the label on the floppy to make sure it matches *exactly* the label in the prompt.

- **Unable to create directory "*zzzz*":**

The install program was unable to create the directory named. The most usual cause of this is that a file of the same name already exists. This is unlikely to happen in a new installation.

- **`Unable to execute:`** *xxxx*.

  For some reason, the command shown could not be executed by the install program

- **`Unable to set working directory to`** *d:dir*

  The install program was unable to make the CECL root directory *d:dir* the current working directory. This probably means that the directory could not be created. Possible causes of this are:

  - the disk drive *d* is invalid. Choose another drive.
  - a file by the name of *dir* already exists on the indicated drive. Delete the file, or choose a new root directory name.
  - the directory name, *dir* is invalid by DOS standards. Perhaps it contains invalid characters such as "**>**".
  - the directory name, *dir* was a path name containing at least one super-directory as in, for example, "**`\foo\cecl`**", and at least one of those super-directories does not exist. In this example, if directory **`\foo`** does not exist, then **`\foo\cecl`** cannot be created. Create all super-directories yourself.

1.6 Revision Notes

This section details the revisions made to the program since the first version (Version 1.00) was released to the Ministry of Transport on April 1, 1990. The current version of the program is Version 1.13.

1.6.1 Version 1.10, April 11, 1990

Version 1.10 has mostly some minor changes to the user interface over Version 1.00. There have been a few bug fixes, particularly with respect to the computation of average speed upgrade, both with and without climbing lane, as well as level of service warrants. Some menus may be slightly changed.

1. *(Bug Fix)* In the "Performance Estimates" module (EstPerf), there was a bug in calculating the average speed upgrade with climbing lane for low grades (the average speed with lane was coming out lower than the average speed without lane). This has been fixed.

2. *(Bug Fix)* The level of service warrant check was incorrect, in that a "yes" was indicated whenever the LOS upgrade was lower than the LOS of the approach. As all 2-lane highways are designed for level of service "B", this has been corrected so that a level of service of "C" or lower on the upgrade section means that a lane is warranted.

3. *(Bug Fix)* In the "Performance Estimates" module (EstPerf), a small anomoly in speed versus service flow at 84-85 km/h could have resulted in the average speed upgrade without climbing lane being *very* slightly higher than the approach speed, for low grades (3 percent). This has been fixed to prevent that from happening (simply by limiting the upgrade speed to the approach speed).

4. *(Bug Fix)* Fixed a bug in the "Estimate Performance" module (EstPerf) wherein selecting and executing the "Print Results" menu item would clear the "changed" flag and thus let you exit the module without saving the analysis results in the site file. Later modules would then complain about lack of data.

5. *(Bug Fix)* Fixed a bug in the main CECL menu wherein the window was not properly erased before displaying the site ID, description and file name. This sometimes resulted in a garbled display, particularly when a second site file was chosen that had a shorter ID or description than the previous one.

6. *(Enhancement)* In the Roadway and Traffic Characteristics module (DefSite), the output file name is defaulted from the site ID if that ID is changed during filling out of the form. This makes it easier to create a new site file by modifying an existing one. Previously, the output file name was always defaulted from the input file name.

7. *(Enhancement)* In all modules, the name of the file used for the "Print File" (i.e. the file in which to print analysis results) is defaulted from the site ID by appending the extension "`.prn`". Previously there was no default name.

8. *(Enhancement)* In all modules, the name of the file used for the "Screen Dump File" (i.e. the file used to hold screen dumps) is defaulted from the site ID by appending the extension "`.sd`". Previously there was no default name.

9. *(Enhancement)* Added a "Save Results" item to the action menu in the "Estimate Performance" module (EstPerf). This allows easier and more uniform saving of analysis results in the site file.

10. *(Enhancement)* For all modules, if a "Print Results" menu item is selected and if the print file names an existing file, and the user elects to append to that file, a form-feed is written to the file to separate outputs.

11. *(Enhancement)* For all modules, if a user hits "ESC" when being prompted for a file name, and if that file name does *not* contain any wild card characters, then the prompt is re-issued with the file name portion changed to a wildcard ("*"). This makes it easier to reject the default and get a menu of matching files with the same extension displayed.

12. *(Enhancement)* In the main module (CECL), the site ID as well as the site file name can now be given as a command line argument.

1.6.2 Version 1.11, April 22, 1990

1. *(Bug Fix)* Fixed small bug in selection of acceleration or deceleration curve in module "DefCL" (the bug would probably not have affected anything).

2. *(Bug Fix)* Fixed bug CPR001 in module "EstPerf" wherein a "No" would always be printed for "Truck Warrant" when truck speeds were not explicitly calculated. Now the printout clearly states when truck speeds have not been calculated.

1.6.3 Version 1.12, August 15, 1990

1. *(Bug Fix)* Changed calculation of benefits due to delay reduction to include only the upgrade traffic, and not the traffic in both directions. This is likely conservative, as down grade traffic also benefits from the addition of a climbing lane, but those benefits are not easily quantified and are ignored. The benefits due to accident reduction still includes traffic in both directions.

1.6.4 Version 1.13, September 5, 1990

1. *(Enhancement)* Added much range checking of input data, through addition of limits descriptors to numerical form fields. These limits are classified into 3 levels: "Hard" (limits cannot be exceeded), "Soft" (limits can be exceeded after confirmation) and "Normal" (exceeded limits will produce a warning message). This change has fixed the problems of producing ridiculous results when given improbable input

data (such as a 5% grade for 20,000m). Now, either the input will not be allowed, or the computation will fail with a meaningful error message.

2. *(Enhancement)* Added "Alt-L" hot key for numerical form fields. This will cause the current limits to be displayed in the status line, with the possibility of displaying a help window specifically to describe the limits.

3. *(Enhancement)* Added printout of copyright notice by CECL.

4. *(Bug Fix)* Changed so that a colour monitor is automatically detected, and so that colours are properly and automatically initialized for colour displays. Previously, one had to give the "-c" command line option to get colour.

5. *(Internal Enhancement)* Added comments to much of the source code, and did some reorganization so as to aid program maintainers. Enforced a consistent style of comment at the beginning of each function, so that all of these comments could be extracted for the Programmer's Manual. Added copyright notice to all source files.

6. *(Internal Enhancement)* Corrected the bug in Blaise routines that exchanged foreground and background colours, then removed the corresponding work around in the colours module.

2 Getting Started

Users who have had some experience in operating screen-oriented PC software should have little trouble learning the details of CECL operation and input preparation. The main features of CECL are:

- Data is entered by filling out on-screen forms. Field data values in a form may be numeric or a choice from a limited number of alternatives. After a field value has been entered, the cursor moves automatically to the next field.
- Numeric values are entered by typing the value, then hitting the "`Enter`" key.
- Choices are made by selecting from menus. Selection is accomplished by using the four arrow keys to move the highlight bar to the desired response in the menu, then hitting "`Enter`".
- Extensive context-sensitive on-line help is available at all times. For example, pressing the "`F1`" key will display a message explaining the input that is required at any particular time, and pressing "`Alt-F1`" will display a message listing the special keys that can be pressed.

See Section 2.1 for details on how to start the CECL system executing.

See Section 2.2 for a brief overview of how to use CECL to analyze a potential climbing lane location.

See Section 2.3 for a more complete overview of the more important data entry concepts, including the use of data-entry forms in Section 2.3.2.

See Chapter 4 for detailed, step-by-step examples of entering data and analyzing potential sites.

2.1 Running CECL

The entire CECL system is comprised of a number of relatively independant modules which can be run separately. However, the main controlling

module is called "CECL" and only this module need be run directly from DOS. To run CECL, simply type:[1]

```
CECL
```

and you will be presented with a menu of choices to direct CECL in its further operation.

2.1.1 Command Line Options

When running CECL from DOS, several options are possible. The full DOS command-line is as follows:

`CECL` *option* ...

where *option...* is zero or more non-conflicting options selected from the following list:

`-c` *Colour.* CECL will operate in colour mode (for colour monitors) rather than monochrome. The default depends on the display type of the computer if this option is not given.

`-m` *Monochrome.* CECL will operate in monochrome mode. This is the default.

`-hn` *Novice help level.* CECL will start in Novice help level. When set to "Novice" level, CECL always issues an initial prompt for the introductory help system, and always displays a initial help window when that system is entered.

The default help level, if no command-line option is given, depends on the setting of the Help-Level configuration file variable (see Section 3.2), and is initially set to Novice.

`-hi` *Intermediate help level.* CECL will start in the Intermediate help level. The difference from Novice is that there is a different default answer to the initial prompt, and the initial help window is not displayed.

`-he` *Expert help level.* CECL will start in the Expert help level. In this case, the initial prompt offering to display the introductory help system will not be given ("`Alt-H`" will still display the introductory help, though).

[1] This assumes that `AUTOEXEC.BAT` has been modified to add the CECL root directory to the DOS command search `PATH`. If this has not been done, you may need to type a more complicated command giving the full path name, for example: "`C:\CECL\CECL`".

2.2 Using CECL

2.2.1 Sites and Site Files

Important terms to know when using CECL are those of "*site*" and "*site file*". A site is simply some section of roadway that you wish to analyze for a potential climbing lane. You must assign a unique identifier to each site; the identifier is used by the software to distinguish among the various sites.

A site file is a DOS file that contains all pertinent information describing the site. The various CECL modules read data from the site file, perform some analysis using that data, then add more data to that same site file.

The name of the site file is usually derived from the site identifier, by adding the DOS file extension "`.rtc`", thus the site identifier is limited in length to eight characters and should not contain any characters that are illegal in a DOS file name.

Before invoking the various modules of CECL, you must indicate which site you are working on. You may do this by creating a new site and specifying the roadway and traffic characteristics, or by selecting an existing site with that data already filled in. You may create a new site by selecting an existing site, changing some of the parameters, and saving the data in a new site file.

2.2.2 Analyzing a Site

When analyzing a site using CECL, certain steps must be performed in the correct order. The remainder of this section outlines those steps, but does not provide detailed information about them.

In summary, referring to the main CECL menu shown in Figure 2.2, you must select each of the main menu items in turn to: 0) create a new site or select an existing one; 1) input the site description; 2) specify climbing lane geometery; 3) estimate performance, and 4) estimate effectiveness.

Run CECL

First, run CECL from DOS, using the command lines as given in Section 2.1, above. Unless the configuration variable "**`Help-Level`**" (see Section 3.2) is set to "Expert", you will see a menu prompt such as that shown in Figure 2.1.

Answering "Yes" to that prompt will bring up the introductory help system. That system provides a menu that allows you to browse to a limited extent, reading various help screen dealing with general concepts. You can press the "`F1`" key for an explanation of how to answer the prompt.

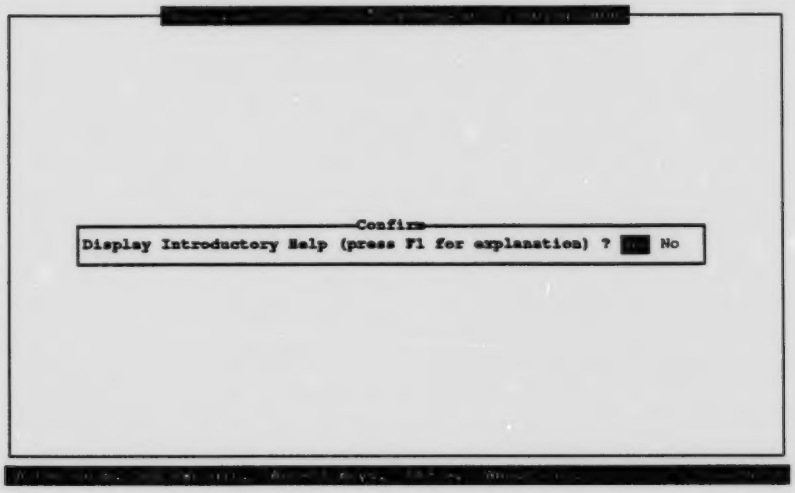

Figure 2.1: Initial CECL Prompt

Answering "No", or pressing the "Esc" key, or selecting "Quit" from the help menu, takes you back to the main CECL menu.

Site/File Operations

When that is done, you will be presented with the main CECL menu, and the screen will look like that shown in Figure 2.2.

Select the "Site/File Operations" item from the main menu, then select "New Site" from the file operations menu. You will then be asked to supply the site identifier, a short description of the site, and the name of the site file (see Section 2.3.2, below, for a discussion of the various input possibilities when you are prompted for a file name). When you have done that, you will be returned to the main CECL menu.

Input Site Description

Select the "Input Site Description" item from the main menu. This will invoke the module that lets you input the roadway and traffic characteristics for the site. It does this by displaying a form on the screen and letting you move around to the various fields, typing or selecting the appropriate values. Generous use of the "F1" key should make it clear what is expected from you as input.

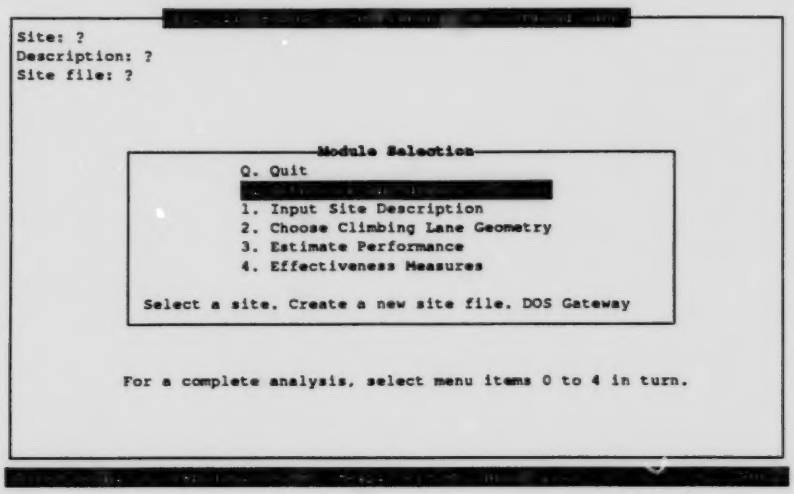
Site: ?
Description: ?
Site file: ?
Module Selection
Q. Quit
1. Input Site Description
2. Choose Climbing Lane Geometry
3. Estimate Performance
4. Effectiveness Measures
Select a site. Create a new site file. DOS Gateway
For a complete analysis, select menu items 0 to 4 in turn.

Figure 2.2: Main CECL Menu

When all of the data has been entered, select "Yes" for the final choice field, "**Save ?**". You will then enter into a dialogue regarding the name of a site file in which to save the data.

When that is done, you will be returned to the main CECL menu.

Choose Climbing Lane Geometry

Next, you must choose the start and end locations of the proposed climbing lane. Choosing "Choose Climbing Lane Geometry" from the main menu will invoke the module that lets you compute the location based on truck speed differential, or that lets you input the start and end locations yourself. Very little input data is required at this stage, and the module initially presents only a menu from which you can choose the various options.

When you are satisfied with the lane location, save that data to the site file and quit from the module.

Estimate Performance

Next, it is necessary to estimate the performance of the proposed lane. That is, we compute its effect on level of service, average speeds and delays, and accident rates.

Select "Estimate Performance" from the main CECL menu to perform this analysis. This module presents you with a very small data form to fill in, to provide details like design speed and lane widths. When these has been filled in, results will be calculated and you will be presented with a menu of further operations.

Use this menu to save the data, exit from the module and return to the main CECL menu.

Effectiveness Measures

Finally, choose "Effectiveness Measures" from the main CECL menu. This invokes the menu that allows you to compute various effectiveness measures and do a cost-benefit analysis. The module presents an initial data form to fill in, then presents a menu of choices for further operations.

2.3 User Interface Concepts

This section provides an explanation of the general concepts underlying the user interface to CECL, and mentions some of the keys that can be pressed in various situations.

There are basically three methods of providing input to CECL: selecting from menus, filling in data entry forms on the screen, and responding to "prompters". A menu is used to select one of a limited number of choices and can be used, for example, to select program options or to select a single file from a number of candidate files.

A data entry form consists of a number of fields, each of which requires and accepts a single value. Some fields may require numeric input (integer or floating point), while others may require a selection from a menu. When a value has been given for a field, the cursor automatically moves to the next field in the sequence.

A prompter is a small, one-line window that is "popped" up on the screen for the purpose of soliciting one response, after which the window is deleted from the screen. Again, some prompters require numeric values, some require arbitrary text, and some require a selection from a menu. In prompters of the latter type, the possible choices are displayed when the prompter is displayed.

In all cases, extensive on-line help is available.

2.3.1 Getting Help

The user interface of CECL has been designed to provide full help to the novice user. At the same time, it was designed so as to not seriously impede

the experienced user. Therefore, all displays of on-screen help messages must be *requested*, they are not presented automatically. CECL provides four types of help message, and four different key-strokes to request display of these:

Alt-H *Help.* Pressing this key invokes the introductory help system. A menu of choices is presented on the screen, from which you can choose the help display of your choice. This help system is intended to provided an overview of the important concepts; it does not provide detailed, module-specific information.

F1 *Explain* Pressing this key displays a message that provides specific information about the input required at the point of the cursor on the screen. That is, on the input required at any instant.

Alt-F1 *Keys* Pressing this key displays a message that provides detailed information about the various keystrokes that can be given, and the effect of each.

Ctrl-F1 *About ...* Pressing this key displays a message that gives a brief overview of the current module.

2.3.2 Types of Input

Menus

Normal menus may be displayed so that the possible choices are arranged vertically, horizontally, or in a rectangular grid. In all cases, the highlight bar is moved using the four arrow keys on the numeric keypad, and/or the "**Home**", "**End**", "**PgUp**" and "**PgDn**" keys. In most cases (the file menus being the exception), typing the first character of the displayed item will also move the highlight bar to that item. Hitting the "**Enter**" key will select the item that is currently highlighted.

In all cases, hitting the "**Esc**" key will exit from the menu without making a selection. What happens in this cases depends a bit on the type of menu. In most cases, the program will simply continue with what it was doing before the menu was displayed.

In some menus, certain items are temporarily "protected" from selection, often because some other item must be selected first. These protected items are shown in a different colour in the menu.

A **File Menu** is displayed whenever the response to a file prompt (see below) contains wildcard characters. In this case, all files in the current working directory whose names match the wildcard are displayed, along with all subdirectories (these have a "\" character appended to show that

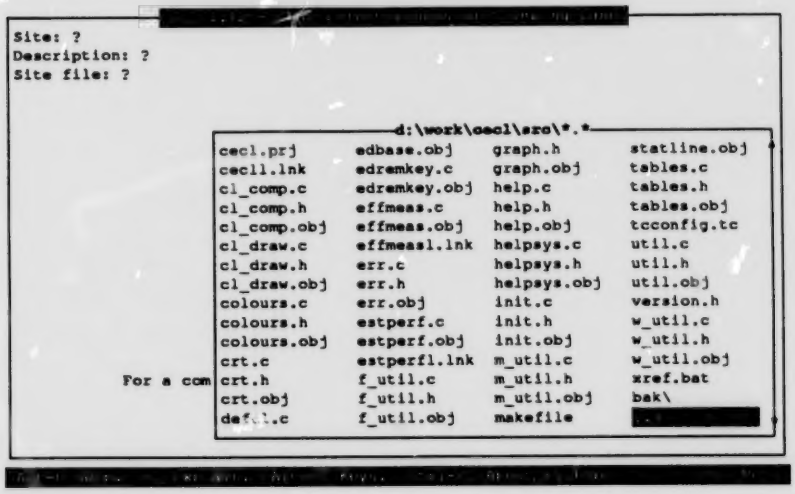

Figure 2.3: Scrolling File Menu

they are directories). Selecting a file name selects that file, selecting a directory name results in all matching files in that directory being displayed. Hitting "**Esc**" results in a return to the file prompt, at which time you can change the name.

If there are many matching files, the menu becomes scrollable (indicated by small arrows in the right border). The positioning keys still work in the same manner. Figure 2.3 shows such a menu.

Data Forms and Form Fields

A data form is a sequence of fields. Each field requires a single value. That value may be a number, it may be arbitrary text, or it may require a choice from a menu. You supply the value for a field by moving the cursor to that field and either typing or selecting the value. If the field requires you to type a value, the default value is displayed in a different colour and you use the normal editting keys to delete characters and add new characters. Hitting the "**Enter**" key "accepts" the currently displayed value, and, if there are no errors, moves the cursor to the next field.

If the field is a **choice field**, it requires a selection from a menu. That menu is popped up when the cursor moves to the field.

In all cases, hitting "**Esc**" will move you to the next field without changing the current field.

You can return to previous fields to change their contents. Use the "up arrow" key to go to a previous field. Use the "down arrow" key to move to the next field.

When editting a numerical field in a form, the user may hit the "Alt-L" key to see what limits, if any, are placed on the numerical value. Limits are of 3 kinds: Hard limits are those which can never be exceeded; Soft limits are those that can only be exceeded after confirmation, and Normal limits are those which result only in a warning message if they are exceeded.

In all cases, hitting "Alt-G" (i.e., Go) will terminate data entry of the current form. What happens then depends on which form is being displayed, but in all cases it is equivalent to what happens when the form is completed normally.

Prompters

A **prompter** is a small (usually one line) window that is temporarily "popped up" to solicit one response or value. The type of value to be provided should be clear from the context, and may be a number, an arbitrary string, a choice from a menu, or a file name. A prompter usually supplies a default response, and that can be editted, erased, or accepted as is. Hitting the "Enter" key accepts the value.

A **confirmer** is a prompter that requires a "Yes" or "No" answer, and displays a menu of the choices. The answer is made by using the arrow keys, or by typing "Y" or "N" to move the highlight bar, then pressing "Enter".

A **file prompter** requires you to supply the name of a file. If that file name contains DOS wildcard characters ("*" or "?"), a file menu will be displayed of all matching files. Hitting the "Esc" key to the file menu will then return you to the file prompter, at which time you can change the file name bey editting the default.

2.3.3 Status Line

The status line at the bottom of the screen reminds the user of the type of help available at any one time. It is also used to display error messages, and sometimes simply reminds you of how to delete the help window that is currently displayed.

3 Files and Changing Things

CECL requires a number of files for its operation. These files are each located by searching in a number of standard locations, stopping as soon as a file of the correct name is found. In this way, default locations can make installation and running of the program simple, while at the same time allowing easy file substitution on a temporary or permanent basis.

3.1 Files

This section describes the various files and their purpose, where they are searched for, and how the default files can be over-ridden.

Without exception, all files are first looked for in the current working directory; therefore the simplest way of providing different versions of files is to simply have a copy in your current working directory.

Other search locations may be specified by appropriate variables in the configuration file. See section 3.2 for more information about the configuration file.

Warning. When several versions of a file exist in different locations, no indication is provided as to which version is loaded. This can be confusing.

3.1.1 Configuration file - cecl.cfg

This file provides defaults for many parameters. It is located by the following search procedure:

1. the file cecl.cfg in current working directory.
2. the name given by the DOS environment variable CECLCFG.
3. the file cecl.cfg in the directory containing the executable programs.

3.1.2 Speed Distance Tables

These files provide the speed-distance tables for various truck weights and various grades. For any given truck weight, there are usually three files involved: acceleration downgrade, acceleration upgrade and deceleration upgrade. They are located by the following search procedure:

1. in the tables sub-directory of the current working directory.
2. in the directories in the search-path specified by the DOS environment variable CECLTABLES.
3. in the directories in the search-path specified by configuration file variable CECL-Tables.
4. in the tables sub-directory of the directory containing the executable programs.

3.1.3 Other executables

This directory contains the executables of all modules and support programs. They are located by the following search procedure:

1. in the current working directory.
2. in the directories in the search path given by the DOS environment variable CECLPATH.
3. in the directories in the search path given by the configuration file variable CECL-Path.
4. in the directories in the search path given by the normal DOS PATH.

3.1.4 BGI files

These are the Borland Graphics Interface (BGI files) used by various graphics modules. They are located by searching, in the order shown:

1. in the current working directory.
2. in the directories along the search path given by the DOS environment variable BGIPATH.
3. in the directories along the search path given by the configuration file variable BGI-Path.
4. in the directory containing the executable programs.

3.1.5 Help File - ceclhlp.hlp

This contains the help display database. It is located by searching in the following manner:

1. File ceclhlp.hlp in the current working directory.
2. File named by DOS environment variable CECLHLP.
3. File named by configuration file variable CECL-Help.
4. File ceclhlp.hlp in the directory containing the executables.

3.2 Configuration File

The configuration file is automatically loaded at the start of each program. This file contains a number of "configuration file variables", each of which provides a default value for some quantity. Most of these quantities are further prompted for by the various modules, so this file provides only the default values. That means that it is unlikely that you will have to change this file.

The first line (and therefore the first 11 characters) of the configuration file must be *exactly*:

```
##Form: CFG
```

The various configuration file variables, their value types, their default values (shown enclosed in "[" and "]") and their meanings, are:

Base-Year: *(integer)* **[1989]** The base year to use for dollar figures in the cost-benefit analyses.

BGI-Path: *(path)* **[\cecl\bgi;\turbo\bgi]** The directory containing the Borland Graphics Interface (BGI) graphics device drivers. This may be a ";" separated list of directories.

CECL-Help: *(file)* **[\cecl\ceclhlp.hlp]** The name of the on-line help database.

CECL-Path: *(path)* **[\cecl]** The directory containing the CECL executables. This may be a ";" separated list of directories.

CECL-Tables: *(path)* **[\cecl\tables]** A ";" separated list of directories to search for the various tables required by CECL (such as the speed-distance tables).

Design-Speed: *(real)* [100.0] The design speed of the highway, in km/h.

DHV-Percent-of-AADT: *(real)* [17.4] Normal traffic flows are given using the design-hourly-volume. This parameter is the default percent that the DHV is of the daily traffic.

End-Speed-Drop: *(real)* [15.0] Currently not used.

End-Transition-Distance: *(real)* [200.0] Currently not used.

Help-Level: *(one of "Novice", "Intermediate" or "Expert")* [Novice] This value controls the initial prompt for the introductory help system. "Expert" removes the initial prompt. "Intermediate" and "Expert" remove the initial help window when the help system is entered.

Inflation-Rate: *(real)* [5.0] Currently not used.

Lane-Fixed-Cost: *(real)* [0.0] The fixed, constant portion of the cost of constructing a climbing lane, in dollars of the base year.

Lane-Maintenance-Cost: *(real)* [0.0] The additional cost of maintaining the climbing lane over and above the normal maintenance cost, in dollars/km/year.

Lane-Unit-Cost: *(real)* [396000.0] The cost of constructing one kilometer of lane.

Life-of-Facility: *(real)* [30] The expected life of the lane, in years.

Maximum-Speed: *(real)* [90.0] Maximum traffic speed, in km/h.

Minimum-Lane-Length: *(real)* [1500.0] The minimum length of a climbing lane, in m.

Peak-Hourly-Factor: *(real)* [1.0] A factor to account for peaking within the hour, as defined by the Highway Capacity Manual, 1985. This number should be less than 1.0 to indicate such peaking.

Real-Rate-of-Return: *(real)* [5.0]

Start-Speed-Drop: *(real)* [15.0] This specifies the speed-drop to use when calculating the position of the start of the climbing lane. Speed distance curves for a "typical" heavy truck are computed. The start of the climbing lane is chosen as the point at which the speed drops to this much below the entry speed,

Start-Transition-Distance: *(real)* [200.0] Currently not used.

Truck-Speed: *(real)* [90.0] This gives the assumed truck speed at the start of the grade, used to calculate speed-distance curves and then to compute climbing lane start and end locations based on speed drop.

Note that the speed distance tables must support whatever value is given here. The default tables distributed with CECL are adequate to a maximum speed of 90. See Section 3.3 for more information.

Truck-Weights: *(integer list)* [120 180] This gives the list of truck weights (in kg/kw) which can be used to compute the start and end locations of the climbing lane.

Note that speed distance tables must be supplied for whichever weights are included in this list. The tables distributed with CECL supply values for weights of 120 and 180. See Section 3.3 for more information.

Vehicle-Accident-Cost: *(real)* [10000.0] The average cost of an accident. This should include an allowance for property damage and injury.

Vehicle-Hour-Cost: *(real)* [5.0] The average hourly vehicle cost to use when computing benefits due to delay reductions.

where:

path means that the value must be a ";" separated list of DOS directory path names.

file means that the value must be a full DOS file path name.

Note: The installation procedure actually changes the configuration file so that the default values for *files* and *paths* correctly reflect the installed location of CECL.

3.3 Speed Distance Tables

In order to compute the start and end locations of the climbing lane, based on the speed drop of a heavily loaded truck, a set of speed-distance tables must be provided for each weight of truck. The default tables distributed with CECL are for truck weights of 120 kg/kw and 180 kg/kw.

For each weight of truck, three tables must be supplied, each in a separate data file. The tables must give speed-distance data for accleration downgrade, acceleration upgrade, and deceleration upgrade.

The following file names must be used:

m2tnnn.ad – for acceleration downgrade.
m2tnnn.au – for acceleration upgrade.
m2tnnn.du – for deceleration upgrade.

where:

nnn is the truck weight, in kg/kw.

The accleration tables must start at a speed of 0 km/hr and contain data for increasing speeds up to the truck speed given in the configuration file, or to the maximum speed attainable on the grade, whichever is least.

The deceleration table must start at a speed at least as high as the truck speed given in the configuration file and must contain data for decreasing speeds down to the maximum speed attainable on the grade, or until a distance of 3000m has been covered.

The upgrade tables must contain data for grades of 0%, 1%, ... 10%, in increments of 1%. The first 2 data columns give speed and distance for 0%, the second two for 1%, and so on.

The downgrade tables must contain data for grades of −10%, −9%, ... −1%, in increments of 1%. The first 2 data columns give speed and distance for −10%, the second two for −9%, and so on.

Each column is exactly 9 characters wide.

The first line of every file must contain a description of the data in the file, as the following example line from file "**m2t120.ad**" shows (note that due to width limitations here, the line is shown in two parts):

```
#SDT M2   Truck     120 kg/kw  90 km/h  AccelDown -10%  -1%
Speed-Dist 90/02/10
```

Columns	Contents
1–4	**#SDT**
6–7	**M2**
11–15	**Truck**
21–23	truck weight
25–29	**kg/kw**
31–33	truck speed
35–38	**km/h**
41–45	**Accel** or **Decel**
46–49	**Up** or **Down**
51–53	percent grade of first curve
54	**%**
56–58	percent grade of last curve
59	**%**
61–70	**Speed-Dist**
72–79	date

4 Examples

4.1 Example 1, Single Grade

This example will involve a section of roadway with a 7% grade for 1000 m, followed by a 0% grade for 1000 m. We will determine the climbing lane locations based on the speed drop of a 180 kg/kw truck as it climbs the grade, then based on its accleration as it traverses the 0% grade at the top. The climbing lane should cover those portions of the roadway where the truck speed is more than 15 km/h lower than the maximum truck speed (which is 90 km/h).

Other relevant data is:

Passing Allowed	
% No-passing zones	0
Design Hourly Volume	300 500 1000 1500
% Traffic upgrade	50
% Trucks	10
% RVs	10

4.1.1 Preparing Input Data and Computing Results

Run CECL

Type the following DOS command to start CECL executing:[1]

```
C:\CECL\CECL
```

Select Site/File Operations

To indicate which site you wish to analyze, select "Site/File Operations" from the main CECL Module Selection menu, as shown in Figure 4.1.

[1] Assuming that CECL has been installed in subdirectory CECL of drive C:. See Chapter 1 for installation instructions.

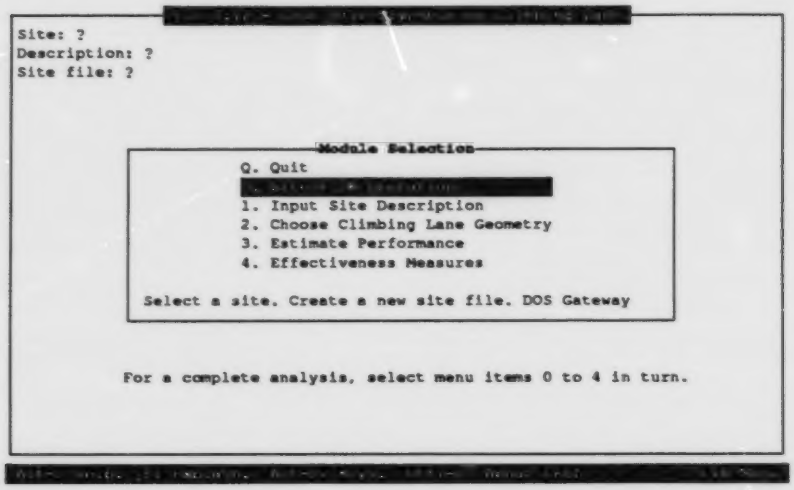
Site: ?
Description: ?
Site file: ?
Module Selection
Q. Quit
1. Input Site Description
2. Choose Climbing Lane Geometry
3. Estimate Performance
4. Effectiveness Measures
Select a site. Create a new site file. DOS Gateway
For a complete analysis, select menu items 0 to 4 in turn.

Figure 4.1: Selecting Site/File Operation

Select New Site

To indicate that you wish to begin work on a new site, select "New Site" from the File Operations menu.

Enter Site ID, Description, File

Respond to the prompts for site ID, site description, and site file by entering the following:

Site ID	**example1**
Description	**Example problem from final report**
Site File	**example1.rtc**

The site ID is a short name used to identify the site file. It should be a legal DOS filename. The description is a slightly longer phrase intended to be more descriptive than the identifier.

Exit File Operations

Select "Exit" from the File Operation menu in order to return to the Module Selection menu.

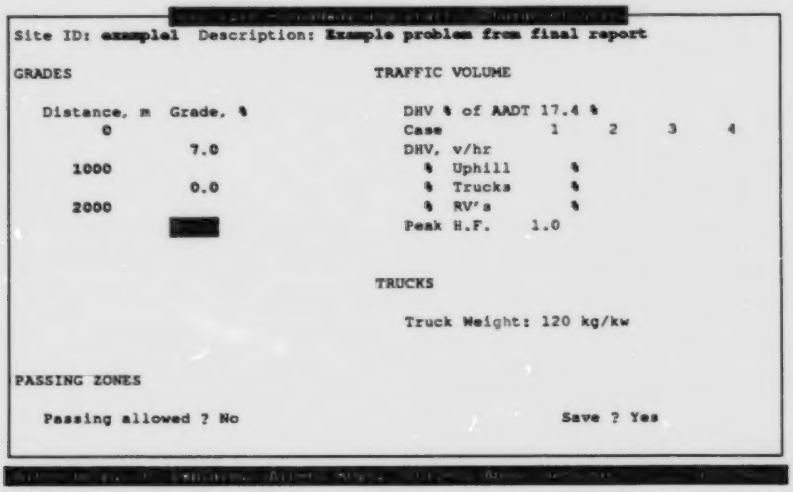

Figure 4.2: Entering Grade Data

Select Roadway and Traffic Characteristics

Now we must input the basic characteristics of the site. Select "Input Site Description" from the Module Selection menu of CECL. This will invoke a module called **DefSite** which will present a data form for you to fill in.

Enter Roadway Data

Figure 4.2 shows the partially completed data form of **DefSite**. To fill in the form, simply type the appropiate values, or select choices from menus. When you press "Enter", the cursor moves to the next field. At any time, you may press "Up" or "Shift-Tab" to return to a previous field, or "Down" or "Tab" to move to the next field.

The figure shows three grade locations having been entered (0, 1000 and 2000 m) and two grades (7% and 0%). Notice that there is space for a few more of each – simply hit "Enter" to indicate that you do not wish to supply values.

Note also that all distance must be entered before any of the grades are entered.

Save Site Description

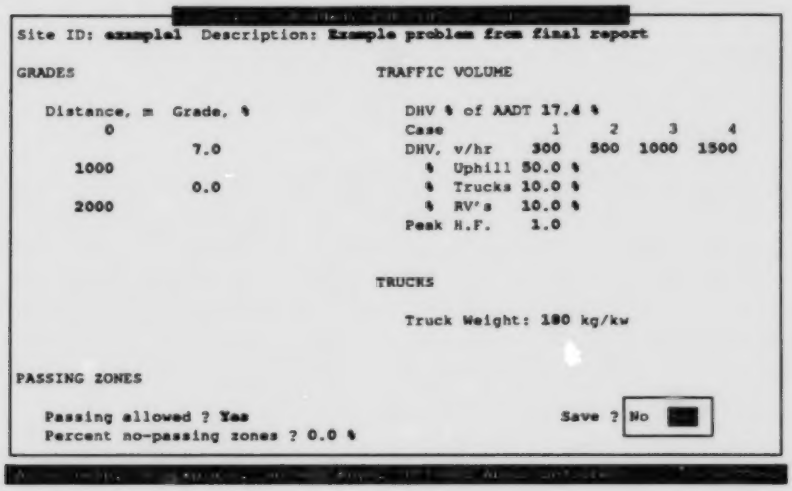

Figure 4.3: Saving Grade Data

When all the data has been filled in, and you are happy with it, answer "Yes" to the Save ? prompt at the end of the form, as shown in Figure 4.3.

After answering the prompts regarding which file to save it in, you will be returned to the CECL Module Selection menu.

In this case, answer the defaults regarding file name; i.e., save the site description in file **example1.rtc**.

Select Compute Climbing Lane Location

In order to compute climbing lane location based on truck speed drop, select "Choose Climbing Lane Geometry" from the Module Selection menu.

This will invoke a module called **DefCL**.

Select Compute Location

As shown in Figure 4.4, you should select "Compute Lane Location" from the Action Selection menu. This will compute speed versus distance of the truck on grade, and will choose lane start and end locations based on the speed differential.

This can take 20 or 30 seconds to do, depending on the speed of the computer.

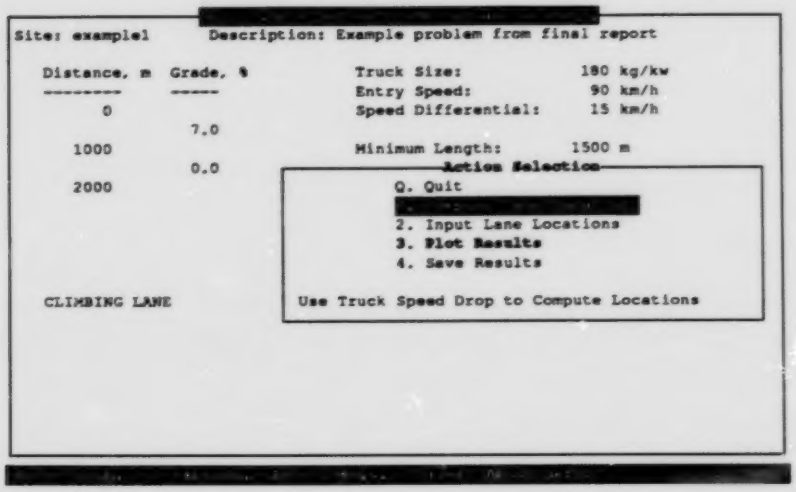

Figure 4.4: Computing Climbing Lane Locations

Select Enter Location

Note that, because the ending 0% grade was arbitrarily ended at a distance of 2000m, the program chose this as the end of the climbing lane. This is because the program cannot compute truck speeds past the end of the last grade section. In this case, the heavy truck had not yet acclerated up to the minimum "no-climbing" lane speed at the end of the 2000m. We could go back to the previous module (**DefSite**) and change that 2000m to 2500m, for example, and redo the analysis. However, in this case, we will simply enter the start and end locations ourselves.

In order to over-ride the locations chosen by the program, select "Input Lane Locations" from the Action Selection menu. Then enter "200" and "2200" for the start and end distances, respectively.

Select Save Results and Quit

Select "Save Results" from the Action Selection menu, specify **example1.rtc** as the name of the site file, then select "Quit" to return to the CECL Module Selection menu.

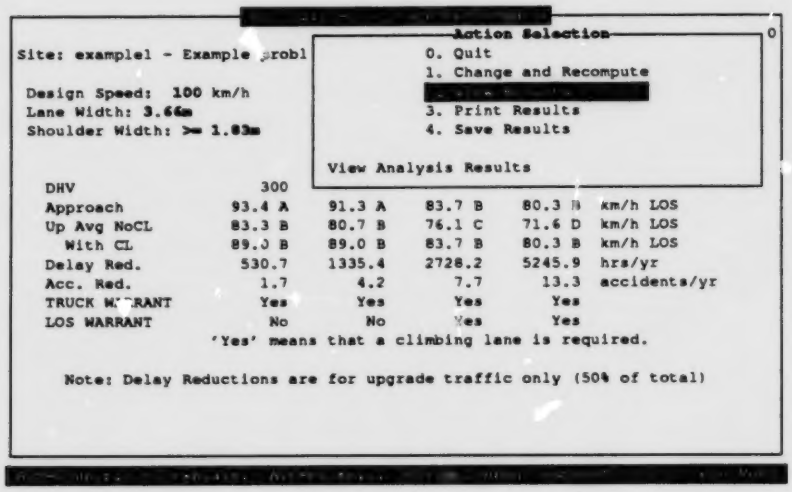
Action Selection
0. Quit
1. Change and Recompute
3. Print Results
4. Save Results
View Analysis Results
Site: example1 - Example probl
Design Speed: 100 km/h
Lane Width: 3.66m
Shoulder Width: >= 1.83m
DHV 300
Approach 93.4 A 91.3 A 83.7 B 80.3 B km/h LOS
Up Avg NoCL 83.3 B 80.7 B 76.1 C 71.6 D km/h LOS
With CL 89.0 B 89.0 B 83.7 B 80.3 B km/h LOS
Delay Red. 530.7 1335.4 2728.2 5245.9 hrs/yr
Acc. Red. 1.7 4.2 7.7 13.3 accidents/yr
TRUCK WARRANT Yes Yes Yes Yes
LOS WARRANT No No Yes Yes
'Yes' means that a climbing lane is required.
Note: Delay Reductions are for upgrade traffic only (50% of total)

Figure 4.5: Estimation of Performance

Select Estimate Performance

In order to estimate the performance of the potential climbing lane (average speeds, levels of service, delay and accident reductions), select "Estimate Performance" from the Module Selection menu.

This will invoke a module called **EstPerf**, which will present you with a small data form to fill in.

Select Start Logging

This module (**EstPerf**) has an optional printout that gives detailed intermediate results of the calculations. To obtain that printout, you must press the "F10" key, then select "Start Logging" from the Pane Menu menu.

Respond with **example1.log** as the name of the log file.

Enter Lane and Shoulder Widths

Enter the design speed, and select the appropriate lane and shoulder widths. In this case, use the defaults provide for each.

After the form is filled out (i.e., after you have answered the last prompt), the results will be displayed and a menu will appear, as shown in Figure 4.5.

You may select "View Results" from that Action Selection menu if you wish an unobstructed view of the results. Press "Enter" to bring back the Action Selection menu.

You may select "Print Results" to place a copy of the displayed results in a file for later printing. If you do, specify **example1.prn** as the name of the file.

Save Data and Exit

Select "Quit" from the Action Selection menu in order to return to the main CECL menu. Before the **EstPerf** module quits, it will ask you if you wish to save the results of the analysis. Answer "Yes" and specify **example1.rtc** (the default) as the file in which to save those results.

Note that you "print" results for your later perusal, but you must "Save" results for use by other modules.

Select Effectiveness Measures

In order to compute and display the various effectiveness measures, including a cost-benefit analysis and other economic data, select "Effectiveness Measures" from the main CECL Module Selection menu.

This will invoke the last module, **EffMeas**, which will present a form for you to fill out. That form will specify various economic parameters, as shown in Figure 4.6.

Accept the defaults for all values in that form. When the last form field is filled in, as it is about to be in the figure, the effectiveness measures will be computed and displayed.

Then an Action Selection menu will be displayed, from which you can choose to plot some of the results, or some other action.

Select View Results

As the effectiveness measures results are too large to fit in one screenful, you must select "View Results" from the Action Selection menu of **EffMeas**.

This allows you to use the keypad keys to scroll the window in order to see all of the data. Figure 4.7 shows this, with the initial form scrolled partially off the screen to the top.

Pressing "Esc" or "Enter" will restore the Action Selection menu.

Select Quit

Select "Quit" from the Action Selection menu in order to return back to the main CECL menu. Before **EffMeas** quits, it will ask you if you wish to

```
                                                    Sun Aug 19 21:19:47 1990
Site: example1    Example problem from final report

     WEIGHTS
       Delay Reduction:     0.40
       Accident Reduction:  0.60

     COST DATA
       Base Year:  1989
       Real Rate of Return:   5.00 %

       Facility Life:          30 yr
       Vehicle Hour Cost:      5.00 $
       Vehicle Acc. Cost:     10000 $
       Lane Unit Cost:       396000 $/km
       Lane Fixed Cost:           0 $
       Maintenance Cost:          [redacted] $/km/yr
```

Figure 4.6: Effectiveness Measures – Initial Form

```
       Facility Life:          30 yr
       Vehicle Hour Cost:      5.00 $
       Vehicle Acc. Cost:     10000 $
       Lane Unit Cost:       396000 $/km
       Lane Fixed Cost:           0 $
       Maintenance Cost:          0 $/km/yr

  SINGLE EFFECTIVENESS MEASURES:
     DHV                  300      500     1000     1500  veh/hr
     AADT                1724     2874     5747     8621  veh/day
     Delay Red.           5.1      7.6      7.8     10.0  min/100 veh
     Acc. Red.           1.26     1.84     1.66     1.92  acc/M veh-km


  MULTIPLE EFFECTIVENESS MEASURES:
     DHV                  300      500     1000     1500  veh/hr
     Delay Red.         0.101    0.255    0.520    1.000  relative
     Acc. Red.          0.130    0.318    0.576    1.000  relative
     Weighted Eff.      0.119    0.293    0.554    1.000


  COSTS OF ADDING CLIMBING LANE:
```

Figure 4.7: Effectiveness Measures – Results

print the results.

Answer "Yes" to save the displayed results in a file for later printing, and specify **example1.prn** as the name of the print file.

Print Log Files

Issue the DOS commands:

```
PRINT  EXAMPLE1.LOG
PRINT  EXAMPLE1.PRN
```

in order to print the files that were saved in the above procedures.

4.1.2 Results, Example 1

The file **example1.log** contains the optional log of the intermediate results of the performance estimations:

```
CLIMBING LANE PERFORMANCE ESTIMATE        Sun Aug 19 21:17:53 1990
================================

Site: example1      Description: Example problem from final report

  Distance, m  Grade, %
  --------     -----
       0.0
                  7.0
    1000.0
                  0.0
    2000.0

  Average grade from 0 m to 1000 m = 7.00 %

  Lane Start: 200        End: 2200 m
  Highway Design Speed:      100 km/h
  Max. Vehicle Speed:         90 km/h
  Truck Weight:              180 kg/kw
  Percent No Passing Zones:    0
  Percent Upgrade:          50.0
  Percent Trucks:           10.0
  Percent RVs:              10.0
  DHV is                    17.4 % of AADT

     DHV  PHF  VPH
     ---  ---  ---
```

```
 300 1.00  300
 500 1.00  500
1000 1.00 1000
1500 1.00 1500
```

Approach Speed and LOS
****

Passing allowed (0% no-passing zones)
% Upgrade = 50.0, % Trucks = 10.0, % RV's = 10.0
Design Speed = 100 km/h
Lane width 3.66m, Shoulder width >= 1.83m

i	LOS	AS	Et	Er	v/c	fd	fw	fhv	SF
0	A	93.4	2.00	2.20	0.15	1.00	1.00	0.82	344
1	B	90.0	2.20	2.50	0.27	1.00	1.00	0.79	595
2	C	84.0	2.20	2.50	0.43	1.00	1.00	0.79	948
3	D	80.0	2.00	1.60	0.64	1.00	1.00	0.86	1545
4	E	72.0	2.00	1.60	1.00	1.00	1.00	0.86	2414

Approach Speed and LOS for the various DHV's:

VPH	AS	LOS
300	93.4	A
500	91.3	A
1000	83.7	B
1500	80.3	B

Upgrade Speed and LOS without Climbing Lane
****

Grade 7.0 % from 0 m to 1000 m, length = 1.00 km
Proportion passenger cars, Pp = 0.80
Proportion heavy vehicles, Phv = 0.20
Proportion of trucks among heavy vehicles, Pt/hv = 0.50
% Upgrade = 50.0, fd = 1.00

i	LOS	AUS	E	E0	Ip	Ehv	v/c	fd	fw	fg	fhv	SF
0	A	90.0	11.03	2.10	0.179	8.53	0.00	1.00	1.00	0.87	0.40	0
1	B	85.0	7.32	1.80	0.110	5.74	0.13	1.00	1.00	0.92	0.51	172
2	B	80.0	5.20	1.60	0.072	4.15	0.34	1.00	1.00	0.95	0.61	552
3	C	72.0	3.72	1.40	0.046	3.04	0.77	1.00	1.00	0.96	0.71	1476
4	D	68.0	3.42	1.35	0.042	2.82	0.86	1.00	1.00	0.97	0.73	1709

5	D	64.0	3.13	1.30	0.037	2.60	0.93	1.00	1.00	0.97	0.76	1918
6	E	56.0	2.91	1.30	0.032	2.43	1.00	1.00	1.00	0.97	0.78	2123
7	E	48.0	2.68	1.30	0.028	2.26	1.00	1.00	1.00	0.98	0.80	2187

Upgrade Speed and LOS for the various DHV's:

VPH	US	LOS
300	83.3	B
500	80.7	B
1000	76.1	C
1500	71.6	D

Upgrade Speed and LOS with Climbing Lane

****

Grade 7.0 % from 0 m to 1000 m, length = 1000 m
Climbing lane from 200 m to 2200 m, length = 2000 m
Climbing lane ends beyond crest.
% Upgrade = 50.0, % Trucks = 10.0, % RV's = 10.0
Passing allowed (0% no-passing zones)

	Without C.L.			With C.L.			
							ssu
vph	s0	s100	ssu	s0	s100	ssu	inc
300	70.8	68.7	70.8	86.2	85.3	86.2	15.5
500	67.6	65.5	67.6	84.2	83.5	84.2	16.6
1000	59.6	57.5	59.6	79.1	79.0	79.1	19.5
1500	51.6	49.5	51.6	74.0	74.4	74.0	22.5

Average Upgrade Speed (AUS) for the various DHV's:

VPH	AS	US	SI	AUS	LOS
300	93.4	83.3	15.5	89.0	B
500	91.3	80.7	16.6	89.0	B
1000	83.7	76.1	19.5	83.7	B
1500	80.3	71.6	22.5	80.3	B

Delay Reductions Upgrade:

****

Distance = 2.2 km

DHV	VPH	NoCL	CL	VTR	AADT	TDR

```
 v/hr  v/hr  km/h  km/h   s/v   v/d  hr/y
  300   300  83.3  89.0  6.07  1724  530.7
  500   500  80.7  89.0  9.17  2874 1335.4
 1000  1000  76.1  83.7  9.36  5747 2728.2
 1500  1500  71.6  80.3 12.00  8621 5245.9

Change in Accident Involvments:
*******************************

  Distance = 2.20 km

            /------ No Lane -------\ /---- With Lane -----\       AI
 VPH  AADT      SR     AIR      AI      SR     AIR      AI     RED.
 300  1724    10.1   355.2     4.9     4.4   229.6     3.2      1.7
 500  2874    10.6   366.6     8.5     2.3   183.0     4.2      4.2
1000  5747     7.5   298.7    13.8     0.0   132.4     6.1      7.7
1500  8621     8.7   324.9    22.5     0.0   132.4     9.2     13.3
```

The file **example1.prn** contains both the final results of the performance analysis, as well as those for the effectiveness measures:

```
                                                  Sun Aug 19 21:17:53 1990
Site: example1 - Example problem from final report

 Design Speed:  100 km/h
 Lane Width: 3.66m
 Shoulder Width: >= 1.83m


  DHV                  300       500       1000      1500    veh/h
  Approach          93.4 A    91.3 A    83.7 B    80.3 B   km/h LOS
  Up Avg NoCL       83.3 B    80.7 B    76.1 C    71.6 D   km/h LOS
    With CL         89.0 B    89.0 B    83.7 B    80.3 B   km/h LOS
  Delay Red.         530.7    1335.4    2728.2    5245.9   hrs/yr
  Acc. Red.            1.7       4.2       7.7      13.3   accidents/yr
  TRUCK WARRANT        Yes       Yes       Yes       Yes
  LOS WARRANT           No        No       Yes       Yes
                  'Yes' means that a climbing lane is required.

     Note: Delay Reductions are for upgrade traffic only (50% of total)


                                                  Sun Aug 19 21:19:47 1990
Site: example1    Example problem from final report

     WEIGHTS
```

```
    Delay Reduction:      0.40
    Accident Reduction:   0.60

  COST DATA
    Base Year:  1989
    Real Rate of Return:    5.00 %

    Facility Life:          30 yr
    Vehicle Hour Cost:      5.00 $
    Vehicle Acc. Cost:     10000 $
    Lane Unit Cost:       396000 $/km
    Lane Fixed Cost:           0 $
    Maintenance Cost:          0 $/km/yr

SINGLE EFFECTIVENESS MEASURES:
   DHV                300      500     1000     1500  veh/hr
   AADT              1724     2874     5747     8621  veh/day
   Delay Red.         5.1      7.6      7.8     10.0  min/100 veh
   Acc. Red.         1.26     1.84     1.66     1.92  acc/M veh-km


MULTIPLE EFFECTIVENESS MEASURES:
   DHV                300      500     1000     1500  veh/hr
   Delay Red.       0.101    0.255    0.520    1.000  relative
   Acc. Red.        0.130    0.318    0.576    1.000  relative
   Weighted Eff.    0.119    0.293    0.554    1.000


COSTS OF ADDING CLIMBING LANE:
   Lane Length = 2.00 km     Roadway Length = 2.20 km
   Lane Construction Cost = 396000 $/km
   Lane Maintenance Cost = 0 $/km/yr

   Total Lane Construction Cost =     792000 $ =      26400 $/yr
   Total Lane Maintenance Cost                =          0 $/yr
   TOTAL LANE COST                            =      26400 $/yr


BENEFITS FROM ADDING CLIMBING LANE:
   DHV                300      500     1000     1500  veh/yr
   Delay Red.       530.7   1335.4   2728.2   5245.9  hr/yr
   Acc. Red.         1.74     4.24     7.67    13.32  acc/yr

 Without discounting of benefits:
   DR Benefits       2653     6677    13641    26229  1989$/yr
```

AR Benefits	17380	42360	76730	133200	1989$/yr
Total Benefits	20033	49037	90371	159429	1989$/yr
Net Benefits	-6367	22637	63971	133029	1989$/yr

With discounting of benefits using a 5.00% rate of return:

DR Benefits	1360	3421	6990	13440	1989$/yr
AR Benefits	8906	21706	39318	68254	1989$/yr
Total Benefits	10265	25127	46307	81694	1989$/yr
Net Benefits	-16135	-1273	19907	55294	1989$/yr

COST-EFFECTIVENESS VALUES:

DHV	300	500	1000	1500	veh/hr
AADT	1724	2874	5747	8621	veh/day
Annual Cost	26400	26400	26400	26400	1989$/yr
Cost	4.20	2.52	1.26	0.84	1989$/100 veh
Cost	1.91	1.14	0.57	0.38	1989$/100 veh-km

Effectiveness: Single Measures

Delay Red.	531	1335	2728	5246	hr/yr
Delay Red.	5.06	7.64	7.80	10.00	min/100 veh
hr/$	0.02	0.05	0.10	0.20	veh-hr/1989$
$/hr	49.75	19.77	9.68	5.03	1989$/veh-hr
Acc. Red.	1.7	4.2	7.7	13.3	acc/yr
Acc. Red.	1.26	1.84	1.66	1.92	acc/M veh-km
acc red/$M	65.83	160.45	290.64	504.55	acc red/M1989$
$cost/acc red	15190	6232	3441	1982	1989$/acc red
Weighted Eff.	0.119	0.293	0.554	1.000	

5 Known Bugs and Restrictions

1. The graphics displays do not have any numeric values on the axes of graphs.
2. Printing of results is sometimes awkward, what with log files (for intermediate result logging) and "print results" versus "save results" menu items, etc. The latter names are confusing.
3. The help screens do not do a very good job of describing the basics of forms, menus, Alt-G key, etc. They are probably OK on the details.
4. The modules have to be run in sequence, but very little suggests in any of the documentation.
5. Chapters 6 of this manual and onwards (the on-line help database) are still poorly organized for reading.

Part II

Reference Guide

6 Input Conventions

6.1 Introduction

There are basically three methods of providing input to CECL: selecting from menus, filling in data entry forms on the screen, and responding to "prompters". A menu is used to select one of a limited number of choices, and is used, for example, to select program options and to select a single file from a number of candidate files.

A data entry form consists of a number of fields, each of which requires and accepts a single value. Some fields may require numeric input (integer or floating point), while others may require a selection from a menu. When a value has been given for a field, the cursor automatically moves to the next field in the sequence.

A prompter is a small, one-line window that is "popped" up on the screen for the purpose of soliciting a single response, after which the window is deleted from the screen. As for form fields, some prompters require numeric values, some require arbitrary text, and some require a selection from a menu. In prompters of the latter type, the possible choices are displayed when the prompter is displayed.

When providing input, the "ESC" key:

1. exits a menu without making a selection.
2. leaves a form field unchanged.
3. exits a prompter without providing a value.
4. deletes help window from screen.

When providing input, the "Enter" key:

1. selects the currently highlighted menu selection.
2. signals that the form field entry has been completed.
3. signals that the prompter value has been entered.

For all types of input, extensive on-line help is available. Four types of help are available at almost all times:

Help Key Alt-H invokes the introductory help system. It is intended to present brief overviews and general concepts.

Explain Key F1 always display a help window describing the data input or response that is expected, and does so in terms of the application (i.e., what it will mean to select a certain value).

Keys Key Alt-F1 always displays a detailed list of the various keystrokes taht are applicable in any context.

About Key Ctrl-F1 displays general information about the current module.

Pane Menu Key F10 pops up a menu that allows you to perform some common operations, such as exiting the program or escaping to a DOS shell.

The status line at the bottom of the screen indicates these help keys.

File menus display menus of files matching wildcard names. You can browse around, looking for files, changing directories, etc. See Figure 6.1, for example. In file menus, names of directories end in backslash.

If there are too many matching files to fit within the window, the file menu becomes a scrolling menu (indicated by the presence of up and down arrows (↑ and ↓) on the right border of the menu. Figure 6.1 shows this case.

6.2 Introductory Help System

The introductory help system is available at any time through use of the "Alt-H" key. An offer to display it is also made when "CECL" starts executing (unless the Help-Level is set to "Expert").

Because much help is available at any time simply by pressing one of four special keys, and because the status line (the bottom line on the screen) constantly reminds you of which keys can be pressed to get that help, the introductory help system serves mainly to present some important introductory concepts that may not be obvious to first time users.

6.2.1 Help Window Concepts

This help window presents some important introductory concepts for new users of CECL.

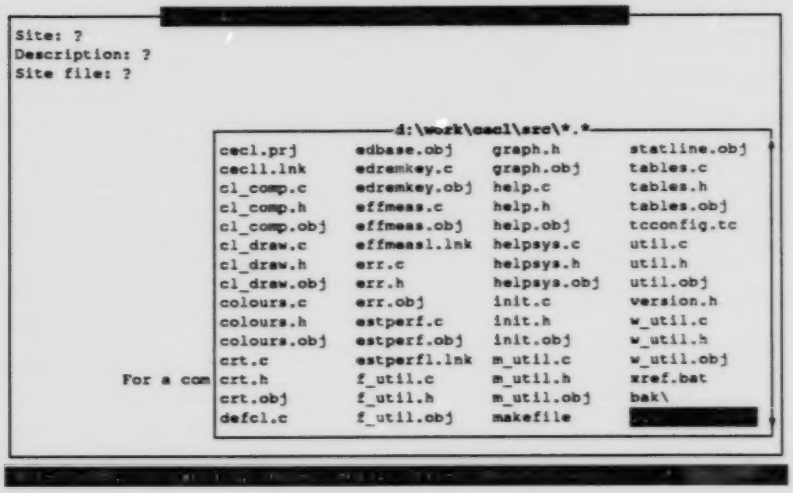

Figure 6.1: Scrolling File Menu

Press the "Enter" or "Esc" keys to erase help windows, such as this one, from the screen; this allows you to return to what you were doing before they were displayed.

Press the "PgUp" or "PgDn" keys to scroll the text within help windows; small arrows appearing in the right border of the window indicate when this is necessary, as they do for this window.

Press "PgDn" now to see more of this help message.

When this help window is deleted, you will be presented with a menu of other help information that can be displayed. Directions near the top of the screen will tell you how to display different help messages. If you are a new CECL user, you should particularly read the "Concepts and Introduction" and "Status Line" sections.

Remember that "Alt-H" pressed at any time will also start this same help system, so you can redisplay it at any time.

Figure 6.2 shows the main menu for the introductory help system. The following sections detail the effect of selecting each of the menu items.

6.2.2 Exit

Selecting this menu item will remove the help windows and system from the screen, and will return you to the CECL program.

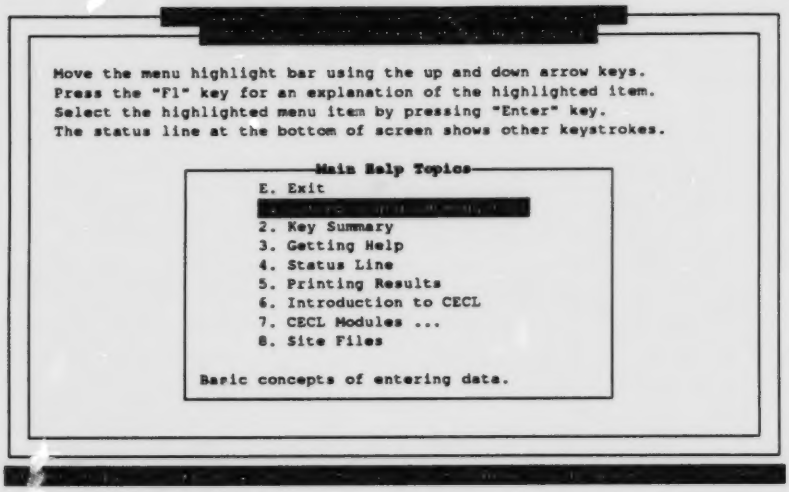
Move the menu highlight bar using the up and down arrow keys.
Press the "F1" key for an explanation of the highlighted item.
Select the highlighted menu item by pressing "Enter" key.
The status line at the bottom of screen shows other keystrokes.
Main Help Topics
E. Exit
2. Key Summary
3. Getting Help
4. Status Line
5. Printing Results
6. Introduction to CECL
7. CECL Modules ...
8. Site Files
Basic concepts of entering data.

Figure 6.2: Introductory Help, Main Menu

6.2.3 Concepts and Introduction

Selecting this menu item will display a help window explaining a few of the more important concepts regarding preparation of input and controlling the various program modules.

6.2.4 Key Summary

Selecting this menu item will display a help window showing a few common special function keys (i.e., "hot keys") and their meanings in different contexts.

6.2.5 Getting Help

Selecting this menu item will display a help window that explains how you can get help for various items at any time. It explains the four help keys, and more.

6.2.6 Status Line

Selecting this menu item will display a help window explaining the contents of the status line (the bottom line of the screen).

6.2.7 Introduction to CECL

Selecting this menu item will display a help window presenting a few of the more important concepts of the application handled by CECL - namely determining the cost-effectiveness of climbing lanes on two lane rural highways.

6.2.8 Printing Results

Selecting this menu item will display a help window explaining how to get various types of hardcopy printout.

6.2.9 CECL Modules

Selecting this menu item will display a second menu from which you can select application-level help for each of the various modules.

6.2.10 Site Files

Selecting this menu item will display a help window explaining the concept of site files. These are the files that maintain relevant site data over a period of time.

6.2.11 Exit

Selecting this item will remove the modules menu and will return you to the main menu of the introductory help menu.

6.2.12 Menu Item

Selecting this menu item will display a help window giving a brief overview of the corresponding CECL module.

6.2.13 Concepts and Introduction

CECL is screen-oriented and menu driven. All user input is supplied by filling in data forms and making choices from menus. A data form is simply a collection of fields arranged on the screen. A field may require an integer, or a real number, a string or a choice from a limited number of possibilites. The first three of these require you to type characters; the latter requires you to make a choice from a menu. When you are currently at a field that requires typed input, the field is displayed in a different colour. When

you are at a field that requires a choice, a menu of the possible choices is displayed.

Pressing the "Enter" key signals that you are finished typing in the field, or that you wish to select the currently high-lighted menu item.

When filling in a form, pressing the "Enter" key will store the currently displayed value and will move you to the next field. "Tab" will also move you to the next field, and "Shift-Tab" will move you to the previous one.

At any field, the "Esc" key will move you to the next field without changing the value of the current one. In a menu, it causes the menu to be exited without making a selection. The "Esc" key is always used to signal that you do not wish to make a choice or to change anything.

At any numeric field of a form, the "Alt-L" key will display the numerical limits imposed on the value, if any. The limits will be displayed in the status line, differentiated as to "normal", "soft", or "hard" limits. These are types of limits in order of increasing firmness.

At any field, the "Alt-G" key (meaning "Go") will store the currently displayed value, and will signal that you do not want to enter any more form values. The form will be exited, and the program will continue with the next step.

To select an item from a menu, you use the four arrow keys to move the highlight bar to the desired item, then press "Enter" to select that item. In most menus, you may also type the first letter of the item to move the highlight bar to that item.

Extensive help of different types is available at all times; see the section "Getting Help" for more information.

6.2.14 Key Summary

The following is a summary of the more commonly used special keys when filling in forms or selecting from menus:

Enter	– accept current value or menu item.
Esc	– do not change value nor select item.
Tab	– accept value, move to next field.
Down	– accept value, move to next field.
Shift-Tab	– accept value, move to previous field.
Up	– accept value, move to previous field.
Alt-G	– (Go) accept value, exit form input.
Alt-X	– exit program.
Alt-L	– show limits for number fields (forms only).

6.2.15 Getting Help

Four special keys are defined so as to provided different types of help at any time:

"**Alt-H**" (Help). The "Alt-H" key will invoke the introductory help system, with which you can browse around for specific topics.

"**F1**" (Explain). The "F1" key will display a help message explaining what input is required at any time. The message is sensitive to the current location of the cursor.

"**Alt-F1**" (Keys). The "Alt-F1" key will display a help message detailing exactly what keys can be pressed for the current input request, and what those keys will do.

"**Ctrl-F1**" (About ..). The "Ctrl-F1" key will display a help message giving a general overview of the current module.

In addition, when filling out a numerical value in a form field, the "**Alt-L**" key will display the program-imposed limits to the numerical value, in the status line.

In addition, a "Pane Menu" can be invoked at any time by pressing the "F10" key. That menu is used to select common options such as printing the screen or exiting the program.

6.2.16 Status Line

The status line is the bottom line of the screen, and has two purposes: to remind you of various special keys and to display error messages.

The normal status line reminds you of the four help keys and of the menu key; it has the following information:

"**Alt-H=Help**" means that the "Alt-H" key will invoke the introductory help system, with which you can browse around for specific topics.

"**F1=Explain**" means that the "F1" key will display a help message explaining what input is required at any time. The message is sensitive to the current location of the cursor.

"**Alt-F1=Keys**" means that the "Alt-F1" key will display a help message detailing exactly what keys can be pressed for the current input request, and what those keys will do.

"**Ctrl-F1=About ...**" means that the "Ctrl-F1" key will display a help message giving a general overview of the current module.

"**F10=Menu**" means that the "F10" key will pop-up a small "Pane Menu" from which you can select common operations such as printing the screen, exiting the program, etc.

When help messages are being displayed, the status line changes to remind you how to scroll through the message, and how to remove it from

the screen.

6.2.17 Introduction to CECL

Introduction to CECL. CECL stands for "Cost Effectiveness of Climbing Lanes" and is pronounced "Cecil".

6.2.18 Printing Results

There are two ways to print the screen, both requiring use of the "F10" menu key. When that is done, you may select either "Print Window Contents" or "Dump Screen".

"Print Window Contents" saves a copy of the current window to a file (you are prompted for the name of the file). The file contains no special characters and so can be printed later using the DOS "PRINT" command.

"Dump Screen" saves a copy of the complete screen in a file. The screen is saved with attributes (i.e., colours) and can only be printed by a special program. No special programs are distributed with CECL, so you probably do not want to use this option.

Some modules will produce a long printout of intermediate result calculations, in a file of your choosing. Such modules are identified by having a "Start Logging" item in the "F10" menu. Select that item, then perform the calculations; intermediate results will be written to the file and you can print it later using the DOS "PRINT" command.

6.2.19 Site Files

A site file is used to maintain all of the data pertaining to a particular site. As each module finishes its part of the computation, it adds more data to the site file, ready for use by the succeeding modules. This implies that modules must be run in the correct sequence.

The correct sequence is: 1) Define Roadway and Traffic Characteristics; 2) Define Lane Geometry; 3) Estimate Performance; and 4) Calculate Effectiveness Measures.

Each of these (except the last), adds data to the site file that is required by subsequent modules.

6.3 Special Keys

This section describes the various kinds of prompts, and the keys that can be used with those prompts.

The following function keys can be pressed at any time:

F1	– to display an explanation of the current data field or menu choice. This always displays specific information about the particular context.
Ctrl-F1	– to display more general information about the current module.
Alt-F1	– to detail exactly what kind of input is expected at any point and what some of the special function keys do.
Alt-H	– to invoke the introductory help system. This allows browsing through some general help screens.

6.3.1 Text Field

In a text field, an arbitrary string of characters is expected; there are almost no restrictions.

Special Keys:

Home	– move cursor to left of field.
End	– move cursor to right of field.
Ins	– toggle insert/overwrite mode (cursor changes).
Del	– delete character at cursor.
Enter	– accept value and move to next field.
Esc	– do not change current value, move to next field.
Backspace	– delete character before cursor.
Left, Right	– move cursor left or right.
Tab	– accept value, move to next field.
Shift-Tab	– accept value, move to previous field.
Ctrl-Home	– erase entire field.
Ctrl-Right	– erase field to the right.
Alt-U	– undo all changes to field.
Alt-G	– Go - accept field, exit form.
F1	– display help message about particular field value.
Ctrl-F1	– display general help message.
Alt-F1	– display this message.

6.3.2 Floating Point Field

A Floating point number is expected. That means an optional leading + or - sign, followed by one ore more digits and at most one decimal point. Examples of valid floating point numbers are:

+13 -12.77 63.4 .5 5.

Special Keys:

Home	– move cursor to left of field.
End	– move cursor to right of field.
Ins	– toggle insert/overwrite mode (cursor changes).
Del	– delete character at cursor.
Enter	– accept value and move to next field.
Esc	– do not change current value, move to next field.
Backspace	– delete character before cursor.
Left, Right	– move cursor left or right.
Tab	– accept value, move to next field.
Shift-Tab	– accept value, move to previous field.
Ctrl-Home	– erase entire field.
Ctrl-Right	– erase field to the right.
Alt-U	– undo all changes to field.
Alt-G	– Go - accept field, exit form.
F1	– display help message about particular field value.
Alt-L	– display the numerical limits in status line.
Ctrl-F1	– display general help message.
Alt-F1	– display this message.

6.3.3 Integer Field

An Integer number is expected. It may contain an optional leading + or - sign, followed by one or more digits and no decimal point (unless it is the last character). Examples of valid integers are:

13 -12 0 +45.

Special Keys:

Home	– move cursor to left of field.
End	– move cursor to right of field.
Ins	– toggle insert/overwrite mode (cursor changes).
Del	– delete character at cursor.
Enter	– accept value and move to next field.
Esc	– do not change current value, move to next field.
Backspace	– delete character before cursor.
Left, Right	– move cursor left or right.
Tab	– accept value, move to next field.
Shift-Tab	– accept value, move to previous field.
Ctrl-Home	– erase entire field.
Ctrl-Right	– erase field to the right.
Alt-U	– undo all changes to field.
Alt-G	– Go - accept field, exit form.
F1	– display help message about particular field value.
Alt-L	– display the numerical limits in status line.
Ctrl-F1	– display general help message.
Alt-F1	– display this message.

6.3.4 Choice Field

You must select one of a limited number of choices from a menu. Use the arrow keys (Left, Right, Up, Down) to highlight the item you wish to select, then press Enter to select that value.

Special Keys:

Left, Right	– move highlight bar to particular item.
Up, Down	– move highlight bar to particular item.
Enter	– accept the currently selected item.
Esc	– Exit menu without making a selection.
F1	– display help message about particular field value.
Ctrl-F1	– display general help message.
Alt-F1	– display this message.

6.3.5 Menu Choice

You must select one of a limited number of choices from a menu. Use the arrow keys (Left, Right, Up, Down) to highlight the item you wish to select, then press Enter to select that value.

Special Keys:

Left, Right	– move highlight bar to particular item.
Up, Down	– move highlight bar to particular item.
Enter	– accept the currently selected item.
Esc	– Exit menu without making a selection.
F1	– display help message about particular item.
Ctrl-F1	– display general help message.
Alt-F1	– display this message.

6.3.6 File Name Field

You must supply a valid OS file name. Names may contain a drive name, and directory names. The last component (the file name) may be wildcarded (i.e., contain "*" and "?" characters).

If the name is wildcarded, you will be presented with a menu of all existing files whose names match that wildcard. If the displayed filename is not wildcarded, pressing ESC may change the filename component to a wildcard, leaving the directory names and extension unchanged.

Special Keys:

Home	– move cursor to left of name.
End	– move cursor to right of name.
Ins	– toggle insert/overwrite mode (cursor changes).
Del	– delete character at cursor.
Enter	– accept currently displayed name.
Esc	– remove prompt without selecting a name. or change filename to a wildcard name.
Backspace	– delete character before cursor.
Left, Right	– move cursor left or right.
Ctrl-Home	– erase entire name.
Ctrl-Right	– erase field to the right.
F1	– display help message about particular file.
Ctrl-F1	– display general help message.
Alt-F1	– display this message.

6.3.7 File Menu Choice

You must select a file name from a menu of files. The file names shown are those in one directory that match the wild card name displayed as the menu title. Also shown are all sub-directories of the same directory - directories are shown at the end of the list and their names are followed by a "\" character.

Use the arrow keys (Left, Right, Up, Down) to highlight the item you wish to select, then press Enter to select that value.

Selecting a directory will display a menu of all matching files in that directory, allowing you to search for the correct file.

Typing ESC will return you to the file name prompt, at which time you may change drive, directories and/or file name.

Special Keys:

Left, Right	– move highlight bar to particular item.
Up, Down	– move highlight bar to particular item.
Enter	– accept the currently selected item.
Esc	– Exit menu without making a selection.
F1	– display help message about particular field value.
Ctrl-F1	– display general help message.
Alt-F1	– display this message.

6.3.8 Confirmation

You must answer "Yes" or "No" to the question asked.

Special Keys:

Left, Right	– move highlight bar to particular item.
Enter	– accept the currently selected item.
Esc	– Exit menu and answer "No".
F1	– display help message about particular field value.
Ctrl-F1	– display general help message.
Alt-F1	– display this message.

6.3.9 Prompter

You are expected to supply an arbitrary value here.

Special Keys:

Home	– move cursor to left of field.
End	– move cursor to right of field.
Ins	– toggle insert/overwrite mode (cursor changes).
Del	– delete character at cursor.
Enter	– accept currently displayed value.
Esc	– exit prompt without supplying a value.
Backspace	– delete character before cursor.
Left, Right	– move cursor left or right.

Ctrl-Home	– erase entire field.
Ctrl-Right	– erase field to the right.
F1	– display help message about particular value.
Ctrl-F1	– display general help message.
Alt-F1	– display this message.

6.3.10 Viewing a Window

You are currently viewing text that may be too large to display in its entirety in the current window on the screen (small arrows appearing in the right and/or bottom borders will indicate when this this the case). You may scroll the text in any direction to view other parts of it when this happens.

Special help keys, such as "Alt-H", "F1" and the "F10" menu key still work and perform their normal functions. For example, you may select "Print Window Contents" from the "F10" menu to save the contents of this window, in its entirety, to a file for later printing.

Special Keys:

ESC	– stop viewing the window.
Enter	– stop viewing the window.
PgUp, PgDn	– scroll vertically, quickly.
Up, Down	– scroll vertically, slowly.
Ctrl-Left, Ctrl-Right	– scroll horizontally, quickly.
Left, Right	– scroll horizontally, slowly.
Home	– view beginning of text.
End	– view end of text.
Alt-H	– display introductory help system.
F1	– explain current program prompt or state.
Alt-F1	– describe special keys (this message).
Ctrl-F1	– display overview of program.
F10	– display pane menu, for printing, etc.

6.4 Error Messages

This section lists the error messages that can be produced during CECL execution. Some errors require the user to modify the input data — others

are internal programming errors that can only be corrected by the programmer that maintains CECL. In the latter case, carefully note down all messages on the screen, and provide the programmer with a copy of your site file.

6.4.1 Error in Floating Point Field Value

The value of this field must be a valid decimal number. That means it may start with a '+' or '-' sign, contain only decimal digits and have at most one decimal point. At least one decimal digit is required.

Valid decimal numbers are:

+13 -12.77 63.4 .5 5.

6.4.2 Error in Integer Field Value

The value entered for this field must be a valid integer number. That means it may start with a '+' or '-' sign, and contain only decimal digits. It may include a decimal point, as long as no digits follow it. At least one decimal digit is required.

Valid integer numbers are:

13 -12 0 +45.

6.4.3 Error Opening Output File

The output file could not be opened for output. The most common causes of this problem are that the file already exists and is marked "read-only", that one or more of the directories in the path do not exist, or that the file name has an invalid form.

6.4.4 Error Opening Input File

The input file could not be opened for input. The most common causes of this problem are that the file does not exist, or the name was invalid, or one of the directories in the path does not exist.

6.4.5 Input File is not a Form

The file specifed for input does not contain a valid form. Try another file.

6.4.6 Input File is the Wrong Form

The file specified for input contains a data form, but not one of the correct type. Try another file.

6.4.7 Input Form has Bad Value

The file specified for input contains an invalid data value for one of the fields. This usually indicates a program error, unless the file has been manually edited.

6.4.8 Input Form has Invalid Field

The file specified for input contains a form field that is unacceptable to the program. This usually indicates a program error, not a user error. Contact a programmer.

6.4.9 Missing Value in Input Form

The file specified for input is incomplete, in that one or more fields have undefined values. Perhaps you haven't run all the requisite modules.

6.4.10 Unable to Execute Command

The program was unable to execute the command required to invoke one of the modules. The most common causes of this problem are lack of memory, and inability for DOS to find the program.

If you have a number of TSR programs (such as SIDEKICK (TM)) resident, that may result in lack of memory.

If your PATH variable is not set properly, that may result in DOS not finding the program.

6.4.11 Unable to Escape to DOS Shell

The program was unable to execute the command required to escape to the DOS shell. The most common causes of this problem are lack of memory, and inability for DOS to find COMMAND.COM.

If you have a number of TSR programs (such as SIDEKICK (TM)) resident, that may result in lack of memory.

If your COMSPEC variable is not set properly, and COMMAND.COM is not in the current directory, that will result in DOS not finding it.

6.4.12 Menu Item Not Implemented

The programmer is a jerk. He added a menu selector item, but has not yet implemented the function to execute it. Complain to him; he deserves it.

6.4.13 Internal Error

Something that can never happen has happened. You have encountered an internal, programming, error. Contact a programmer and tell it the message being displayed in the status line.

6.4.14 Unable to Open Log File

For some reason, it was not possible to open the indicated file for logging of results. Perhaps the name is invalid by DOS rules, or one of the specified directories does not exist. Or perhaps the file exists but is marked "read-only".

6.4.15 Bad first line of SD table

The first line of the speed distance table is not correct. Perhaps its not a speed distance table, or perhaps its corrupted. See Chapter 3 of the manual for an explanation of what the first line should be.

6.4.16 No data in SD file

The Speed-distance data file was empty. This is very strange. I can't go on.

6.4.17 Unable to initialize graphics system

For some reason, we were unable to initialize the graphics screen. Perhaps you don't have a graphics screen.

6.4.18 Unable to locate BGI files

Unable to locate the Borland Graphics Interface files. Most likely the configuration file, "cecl.cfg" lies about where the BGI files are. See Chapter 3.

6.4.19 Invalid grade

One of the grades is outside the limits of the speed-distance tables (currently -10% to +10%).

6.4.20 Invalid section

The roadway distances given show at least one section of constant grade having zero or negative length. This won't do.

6.4.21 Line too short

The Speed-distance tables contained a line that was too short. Contact a programmer.

6.4.22 Too many zones

You've got a funny roadway there. I have only the capacity for storing info about a few regions in which the truck speed is below the limit. There are too many such regions in this site.

6.4.23 ndist/ngrade inconsistency

There must be exactly one more distance value given than grade values. There wasn't.

6.4.24 Grade not loaded

The speed distance tables did not contain accleration or deceleration tables for the particular grade. You will likely have to get new speed-distance tables.

6.4.25 Unable to find SD file

I am unable to locate the required speed distance tables. Perhaps the truck weight used is invalid, but more likely the CECL-Tables configuration file variable is not set correctly. See Chapter 3.

6.4.26 Speed outside of tables

The calculations detected a speed that was outside of the speed range provided in the speed-distance tables. Perhaps the truck speed is too high, or perhaps the files are corrupted. Try a lower truck speed.

6.4.27 Site Description Not Done

This module requires that you first run the "Site Description" module in order to input the roadway and traffic characteristics and it appears that

you have not done so. Please return to the CECL main menu and run that module.

NOTE: if you have prepared the site file using an older version of CECL, the problem may be an incompatibility with that older version. Unfortunately, you will have to return to the "Site Description" module and re-save the data in order to proceed.

6.4.28 Lane Geometry Not Set

This module requires that you first run the "Choose Climbing Lane Geometry" module in order to define the start and end locations of the climbing lane. It appears that you have not done so. Please return to the main menu of CECL and run that module.

NOTE: if you have prepared the site file using an older version of CECL, the problem may be an incompatibility with that older version. Unfortunately, you will have to return to the "Climbing Lane Geometry" module and re-compute or re-enter the data in order to proceed.

6.4.29 Lane Performance Not Calculated

This module requires that you first run the "Estimate Performance" module in order to compute reduction in delays and accidents. It appears that you have not done so. Please return to the main menu of CECL and run that module.

NOTE: if you have prepared the site file using an older version of CECL, the problem may be an incompatibility with that older version. Unfortunately, you will have to return to the "Estimate performance" module and re-compute or re-enter the data in order to proceed.

6.4.30 Effectiveness Measures Not Calculated

This module requires that you first run the "Effectiveness Measures" module in order to compute various effectiveness measures. It appears that you have not done so. Please return to the main menu of CECL and run that module.

NOTE: if you have prepared the site file using an older version of CECL, the problem may be an incompatibility with that older version. Unfortunately, you will have to return to the "Effectiveness Measures" module and re-compute or re-enter the data in order to proceed.

6.4.31 Binary SD Tables Not Implemented

For some reason, the speed distance tables used by CECL appear to be the binary versions and not the text versions. Currently, CECL cannot read the binary files.

This is a program error. Contact a programmer.

6.4.32 Internal Error – No Current Form

This is an internal programming error. Contact the CECL programmer and tell her the name of the module currently being executed, this message, and a copy of your site file.

6.4.33 Internal Error – No such field

This is an internal programming error. Contact the CECL programmer and tell her the name of the module currently being executed, this message, and a copy of your site file.

6.4.34 Internal Table Error

An internal programming error has occurred in the "tables" module. Contact a CECL programmer and provide a copy of your site file and the message shown in the status line.

6.4.35 Grade Too Long

The tables for E and E0 (passenger car equivalents for trucks on grade) do not contain data for the grade and length of grade shown. Either the grade is too high, or the length of grade is too long for the given grade.

The maximum grade is 7%, and the maximum length of grade is 6.44km.

6.4.36 Truck Too Slow

It is impossible to determine the E factor (passenger-car equivalents for trucks on grade) because the length of grade specified is too long for the percent of grade. The E table data assumes that a truck will not be able to maintain the stated average speed on grades of that length, and so the E value cannot be determined.

Because the E factor cannot be computed, neither can the average speeds upgrade without climbing lane, and thus neither can delay reductions be computed.

6.4.37 Limit Type Mismatch

An internal progam error has occurred while trying to set the limits for a field variable. The type of the limits does not match the type of the field. Contact a CECL programmer.

6.5 Pane menu

This menu allows you to select various options at any time. You may dump the screen to a file, temporarily escape to DOS, or exit the program alltogether.

6.5.1 Screen Dump to File

A copy of the entire screen will be saved, with attributes, to the indicated file. It can be printed later with a special program such as sd2ps (for printing on Postscript devices).

Note that the screen attributes (colours) and special characters (such as window borders) are included, so the file cannot be printed without special utilities.

6.5.2 Print Window Contents

The text in the current window will be copied to a file of your choosing. That file will contain no screen attributes nor any window borders, so that it can be printed as an ordinary text file. Even if there is more text than can be displayed on the screen at any one time (i.e., even if the window is scrollable), all of the text, both visible and invisible, will be copied to the file.

6.5.3 Quit

Exit from program.

6.5.4 DOS Shell

The DOS Shell selection allows you to temporarily suspend the program and escape to a DOS Shell. Typing "EXIT" at the DOS prompt will return you to the program. Remember that while you are in the DOS Shell, this program is still resident and consuming memory, which may restrict the other programs that may be run.

6.5.5 Toggle Logging

Choosing this item turns logging off if it is on, and on if it is off. Logging means the logging of intermediate results to a file of your choosing. That file may be printed later.

6.5.6 Cannot Get Window Size

Internal error. For some reason, wngetopt() was unable to determine the window size. Therefore, it cannot be printed.

6.5.7 Out of Memory

Internal error. Unable to allocate enough memory to satisfy print request. Therefore, window not printed.

6.5.8 Cannot open output file

It was not possible to open the output print file. The most likely cause is either: a) that the file name is invalid (by DOS rules), or, b) that one of the directories in the path name does not exist, or, c) the file exists but is marked read-only.

7 CECL - System Overview

7.1 CECL - Site/Analysis Selection

This is the main controlling module of the program to evaluate the cost-effectiveness of climbing lanes. Here you select the site you wish to analyze, and the analysis module you wish to run.

You select a site by selecting an existing "site file", or by starting a new site file, for a new site, and defining the site roadway and traffic characteristics.

A complete analysis of any particular site involves describing the site (roadway and traffic characteristics), and performing several different types of analysis, in a set order. If you attempt to run the various modules out of order, (for instance, attempting to calculate the climbing lane parameters before describing the site), you will be requested to run the required prerequisite modules.

7.2 Introductory Help

7.2.1 Display Introductory Help

Unless the configuration file variable Help-Level is set to Expert or the command line option "-he" is given, when CECL starts running the user is immediately asked whether the introductory help system should be displayed. Figure 7.1 shows this initial prompt.

To erase this help message (and to allow you to answer the question), press the "Enter" or "Esc" keys.

Answer "YES" to the question if you are inexperienced at running CECL and you wish to view the introductory help system. Answer "NO" if you do not wish to see the introductory help.

To answer "YES", type a "Y", or use the left and right arrow keys to highlight the "Yes" response, then press the "Enter" key.

Figure 7.1: Introductory Help System, Initial Prompt

To answer "NO", type an "N" or use the left and right arrow keys to highlight the "No" response, then press "Enter".

7.3 The Menu

Figure 7.2 shows the main menu for CECL. The figure shows that no site has been selected yet, and that menu item 1 (Input Site Description) is about to be selected.

The following sections describe the effect of selecting each of the menu items:

7.3.1 Exit

Choose this option when you are finished with the various analysis modules and wish to end the session. You will be returned to the OS prompt.

7.3.2 Site/File Operations

The site and file operations menu allows you to choose an existing site file to work on, or to start work on a new site. You may also perform other file operations, and can temporarily escape to DOS and return.

Site: ?
Description: ?
Site file: ?
Module Selection
Q. Quit
1. Input Site Description
2. Choose Climbing Lane Geometry
3. Estimate Performance
4. Effectiveness Measures
Select a site. Create a new site file. DOS Gateway
For a complete analysis, select menu items 0 to 4 in turn.

Figure 7.2: CECL Main Menu

7.3.3 Input Site Description

Choose this option to enter or edit the site roadway and traffic characteristics. If you choose this option, you will be presented with a data form to fill in. That form will describe the roadway characteristics (grade, passing allowances, etc.) and the traffic characteristics (DHV, % trucks, etc.).

You may choose to revise an already existing site description, or to define a new one. You can define a new site by making changes to an existing one, and saving the data under a new name.

7.3.4 Choose Climbing Lane Geometry

This module allows you to specify the parameters of the climbing lane, or to have those parameters computed by a modelling program. If you have them computed, you may revise the parameters manually before continuing.

This module will also display a plot of the site grade profile, truck speeds and climbing lane location versus distance along the roadway.

7.3.5 Estimate Performance

This module computes the average speeds and levels of service (LOS) for the section with and without climbing lanes. It also computes reduction in

delays and accident involvements due to the addition of a climbing lane.

7.3.6 Effectiveness Measures

This module computes the effectiveness measures and the benefits to be obtained when a climbing lane is added. It computes lane costs, performs a cost-benefit analysis to help you determine economic feasibility.

7.4 File Operations

The file operations menu allows you to choose an existing site file to work on, or to start work on a new problem.

The data for a particular site are maintained in a "site file". Any analysis work requires identification of a particular site file. The site file name is usually derived from site ID.

If you wish to choose an existing site, you will be prompted for the name of a "site file". If the name you supply has a "wildcard" character in it (as does the default name), you will then be presented with a menu of all exisiting site files. The file menu will allow you to browse around, looking for the file you want.

If you start a new site, you will be expected to provide a site identifier and short description, and then to describe the site characteristics.

7.4.1 Exit

Choose this option to end the file operations menu and return to the main menu. If you have not selected a site file to work on, you will be required to do so, later, when necessary.

7.4.2 Open Site

Choose this option to open an existing site file. This will allow you to make modifications to it, and to continue with some further analysis.

You will be asked to supply the name of the site file to work on, and you may be presented with a menu of existing site files to choose from (if the name has wildcard characters in it).

7.4.3 New Site

Choose this option to start a new site analysis. You will be prompted for a site identifier, a short description of the site, and the name of a site file in which to store the data.

7.4.4 Site File

Specify the name of a site file (which is usually the site ID with an ".rtc" extension).

7.4.5 Site ID

Specify a site identification. This should be 8 characters or fewer, and should be a legal DOS filename, without the ".".

7.4.6 Site Description

Specify an arbitrary text here - it is used simply to describe the site a bit better than does the Site ID.

7.4.7 DOS Shell

The DOS Shell selection allows you to temporarily suspend the program and escape to a DOS Shell. Typing "EXIT" at the DOS prompt will return you to the program. Remember that while you are in the DOS Shell, this program is still resident and consuming memory, which may restrict the other programs that may be run.

8 Defining the Site Characteristics

8.1 Roadway and Traffic Characteristics

Figure 8.1 shows a typical screen for this module.

This module allows you to describe the roadway and traffic characteristics for the particular site you are investigating.

In addition to specifying the particulars about the grades at the site, you must specify at least one set of traffic characteristics. You may specify more than one set of traffic characteristics in order to perform a sensitivity analysis.

The following keys are important when reading help messages:

Enter or Esc – erases help message from screen.
PgUp, PgDn – scrolls long help messages.

The following keys are important when entering data in a field:

F1	– displays help about that particular field.
Enter	– finish current field and move to next.
Ins	– toggles insert/overwrite mode.
Home	– move to beginning of field.
End	– move to end of field.
Del	– deletes character under the cursor.

8.1.1 Site ID

The SiteID field is used to uniquely identify one particular analysis. The ID must be a legal MS-DOS filename, without the extension; that is it should start with a letter and must not contain a "." (dot) character.

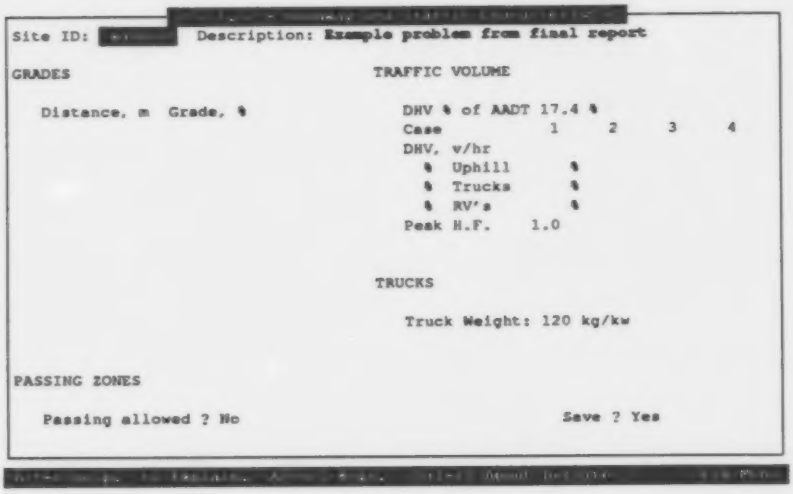

Figure 8.1: Roadway and Traffic Characteristics Form

8.1.2 Description

The Description field can contain any character, and is used only to provide additional identification on all output. It is an arbitrary comment, and is not interpreted by the system in any way.

8.1.3 Grades

Grades may be specified by giving the distances from datum along the roadway, and the grade of the roadway between. For example:

Distance	Grade
0	
	+2
700	
	+4
1000	
	-1
1700	

This specifies a +2% grade for 700m, followed by a +4% grade for 300m, followed by a -1% grade for another 700m.

8.1.4 Use Average Grade

The Highway Capacity Manual (1985) allows you to use an average grade if no single grade exceeds 4%, or if the total length of composite (positive) grade does not exceed 1220 m.

This question is only displayed if the current site meets those guidelines.

Answer "YES" to this question if you want to use that average grade.

8.1.5 Passing Allowed?

Answer "YES" to this question if passing (overtaking) is allowed anywhere within the zone of the grade. Answer "NO" if passing is not allowed anywhere.

If you answer Yes, you will be asked to supply the percentage of no-passing zones.

8.1.6 Percent no-passing zones

This number should typically be 0, 20, 40, 60 or 80 to designate the fraction (in %) of the grade that is marked as "no-passing" zones.

8.1.7 DHV Percent of Average Annual Daily Traffic

This is the estimated percent of the average daily traffic that occurs during the design hour.

The design hourly volumes are specified later in terms of vehicles per hour, with an ability to specify peaking volumes by means of the Peak Hourly Factor.

8.1.8 Design Hourly Volume

The design hourly volume, in vehicles per hour.

8.1.9 Percent of Upgrade Traffic

The percentage of the traffic that is moving upgrade.

8.1.10 Percent of Truck Traffic

Percent of upgrade traffic that is trucks.

8.1.11 Percent of R.V. Traffic

Percent of upgrade traffic that is recreational vehicles.

8.1.12 Peak Hourly Factor

This is a number, as specified by the Highway Capacity Manual (1985), that allows you to account for traffic peaking within the hour. A value of 1.0 specifies no significant peaking, and numbers of less than 1.0 specify varying degrees of peaking.

8.1.13 Truck Weight

The truck weight to use when calculating truck speed drop on grade in order to determine the start and end distance of the climbing lane.

8.1.14 Save the form?

Answer "YES" to this question if you have completed filling in the form and wish to save the data in a file. Answer "NO" if you wish to review and/or change some of the entries.

If you answer YES, the data will be stored in a file whose name, by default, is derived from the Site ID. Before the file is created, you will be given a chance to change the name of the file.

If a file by the same name already exists, you will be asked to confirm whether you want the contents of that file replaced by the values in this form.

8.1.15 Input File

Select the name of a file you wish to use for input to describe the roadway and traffic characteristics. File names are usually derived from the Site ID, but you may specify any name you wish.

8.1.16 Output File

Supply the name of a file in which to store the roadway and site characteristics. This file will become the "site file" for the current site.

The file name is usually the site ID with the extension ".rtc" added to make a legal DOS filename, but the file name can be anything you want, as long as it is a legal file name.

If the name you supply has wildcard characters in it, then you will be presented with a menu of matching files to choose from.

If you choose an existing file, you will be asked to confirm if you really want to overwrite it.

8.1.17 Confirm Overwrite

You have chosen a name for an output file, and file by that name already exists. If you select "Yes", the contents of that file will be replaced by the new data form. If you select "No", the existing file will not be changed and you will get a chance to choose a new name.

8.1.18 Form Has Been Changed

The data form has been changed and you requested program termination. Unless you save the form, you will lose all the changes.

Answer "Yes" to this question to save the changed form.

9 Determining Climbing Lane Locations

9.1 Define Climbing Lane

This module allows you to specify the geometry (i.e., starting and ending locations) of the climbing lane. You may specify these positions yourself, or you may compute them from the speed-distance curves for various vehicles.

The input data for this module must be prepared by Module A – "Roadway and Traffic Characteristics."

9.1.1 Input File

Supply the name of a site file that contains the roadway and traffic characteristics. This is a file that has been created with the Roadway and Traffic Characteristics Form, and normally has an ".rtc" extension. If the name you supply has wildcards (as does the default name), you will be presented with a menu of matching files.

9.1.2 Output File

Supply the name of a site file that contains the roadway and traffic characteristics. The lane locations will be appended to the data in that file, replacing any existing lane locations but not affecting any other data in that file. If the name you supply has wildcards, you will be presented with a menu of matching files.

9.1.3 Start Logging

Start logging intermediate, calculated results to a file. Selecting this option has no effect for calculations that have already been performed.

9.1.4 Log File

Supply the name of a file in which to place the intermediate calculation results.

9.1.5 Exit

Select this option if you wish to exit this module of the program.

9.1.6 Compute Climbing Lane

Select this item if you wish the climbing lane location to be computed using the truck speed on grade, and using the speed differential shown.

That is, a speed-distance curve will be computed for the selected truck on the grades shown, and a climbing lane will be selected for those zones where the computed truck speed is lower than the highway speed by more than the allowed differential. The locations so computed will be adjusted for a start and end transition length, and will also be adjusted to meet the minimum length, if necessary.

You will be able to manually adjust those computed lengths, later, if desired.

9.1.7 Input Climbing Lane Locations

Select this item if you wish to manually input or revise revise the start and end distance of the climbing lane. If you manually revise these numbers, it is your responsibility to ensure that the resulting lane meets all requirements.

9.1.8 Plot the Results

Select this item if you wish to see a drawing of elevations, of speeds versus distance, and of climbing lane locations on the screen.

9.1.9 Save the Results

Select this item if you wish to save the climbing lane locations in the site file so that they can be used by other analysis modules.

9.1.10 Start Distance

If you select an option to manually input the lane locations, you will be prompted for the start and end distances for a single climbing lane.

Enter the distance, in meters, from the start of the grade to the start of the transition zone at the start of the climbing lane.

9.1.11 End Distance

Enter the distance, in meters, from the start of the grade to the end of the transition zone at the end of the climbing lane.

The total length of climbing lane, including the transition zones, should be at least 1500 m. It is your responsibility to ensure that this is the case.

9.1.12 Too Many Climbing Lane Zones

Based on the truck speed model, it was determined that more than one zone of climbing lane was required for the site. This is likely because there is a downgrade in the middle of the section, allowing trucks to accelerate above the minimum speed.

The remaining analysis modules can work with one zone of climbing lane only, and will use only the first zone in the displayed list. You should either manually change the start and end distance so as to have one zone only, or analyze the region of highway as more than one site.

Answer "NO" to this question if you do not want to use only the first zone. In this case, you will be asked to supply new values.

Answer "YES" if it is acceptable to use only the first zone.

9.1.13 Lane Locations Changed

You have computed or manually set a climbing lane location. Unless you save these values in the site file, other analysis modules will not know about them.

Answer "YES" if you wish to save those values.

9.1.14 Lane Locations not Computed

You requested an action that requires the speed-distance curves to have been computed, but you have not asked for that to be done. Select the "Compute Lane Locations" items from the menu, then repeat the request that caused this error.

9.1.15 Lane Locations Have Been Computed

You requested that the lane locations be computed using the truck speed model, but this has already been done. Due to programmer laziness, it cannot be done again. Sorry.

9.1.16 Not Implemented

This can't happen, as it indicates a programmer error, and that is impossibule.

10 Performance Analysis

10.1 Estimate Performance

This module computes the average speeds and levels of service (LOS) for the section with and without climbing lanes. It also computes reduction in delays and accident involvements due to the addition of a climbing lane.

10.1.1 Input File

Supply the name of a file that contains the site description.

10.1.2 Log File

Supply the name of a file in which to place intermediate results.

10.1.3 Start Logging

Start intermediate result logging.

10.1.4 Output File

Provide the name of an output site file to hold the computed results.

10.1.5 Design Speed

Enter the design speed of the highway, in km/h. The design speed is typically 100 km/h, and is not necessarily the same as the truck speed used to compute lane start and end locations.

10.1.6 Lane Width

Select the lane width that best describes the site.

10.1.7 Shoulder Width

Select the shoulder width that best describes the site.

10.1.8 Save Results

Some estimates of climbing lane performance have been calculated. If you wish further analysis modules to make use of these results, the results must be saved in the site file.

Answer "Yes" to this question if you wish those results to be saved for use in further analysis.

Caution – this will over-write any other performance results in the site file.

10.1.9 Print Results File

Supply the name of a file in which to save the displayed analysis results. This file can be printed later. If the file already exists, the new data may be appended to it, without destroying any of the existing data in the file.

10.1.10 Exit Program

Select this item if you wish to exit from the Performance Estimation module.

If you have not already done so, you will be asked to save the analysis results in the site file.

10.1.11 Change Parameters and Recompute

Select this item if you wish to redo the calculations. You may change one or more of the input parameters, and may select "Start Logging" from the F10 menu before the calculations are performed.

10.1.12 View Analysis Results

Select this item if you wish to view the analysis results on the screen, without the clutter of various menus, etc. When you are finished viewing the results, the "ESC" or "Enter" keys will bring you back to this menu.

10.1.13 Print Results

Select this item if you wish to save the analysis results in a file for later printing. The results saved will simply be what you see on the screen, minus menus, window borders, etc.

10.1.14 Save Analysis Results

Select this item if you wish to save the analysis results in the site file. This must be done if you wish further analysis modules to make use of these results.

10.1.15 Performance Estimates

You are viewing the results of the performance analysis. All the results are summarized in the one screen full you see here. If you wish to obtain a longer printout of the intermediate results of these calculations, return to the main menu, press "F10" and select "Start Logging" from that menu, then select "Change Parameters and Recompute" from the main menu.

Press ESC or Enter to return to the main menu.

Some of the abbreviations used are:

DHV – Design Hourly Volume.

LOS – Level of Service.

Approach – approach speed.

Up Avg NoCL – average upgrade speed, no climbing lane.

With CL – average upgrade speed, with climbing lane.

Delay Red. – total delay reduction predicted if a climbing lane is added. This figures includes only the upgrade traffic.

Acc. Red. – total reduction in accidents predicted if a climbing lane is added. This figure is for traffic in both directions.

TRUCK WARRANT – whether a climbing lane is required on the basis of truck speed drop.

LOS WARRANT – whether a climbing lane is required on the basis of level of service reduction.

11 Effectiveness Analysis

11.1 Effectiveness Measures

This module computes the effectiveness measures and benefits for the case of a climbing lane. It also computes cost-effectiveness values. It computes lane costs, performs a cost-benefit analysis to help you determine economic feasibility.

When the module starts, it displays a form requesting input of several values having to do with benefits and costs. All values have defaults read from the configuration file, so the normal case will have you accepting all those defaults.

After the form has been completed, a complete set of analysis results is computed, and a menu is presented allowing you several options, including graphing and/or viewing of results.

You may view the results by scrolling through the display, or go back to change some of the input parameters and recompute.

11.1.1 Input File

Supply the name of a file that contains the site description.

11.1.2 Print File

Supply the name of a file into which the currently displayed analysis results will be placed. These are the results shown on the screen, and they will be copied, in their entirety, to the file. This includes portions that are not visible on the screen.

The file will contain no special characters, and can be printed later on any normal printer.

11.2 The Menu

After the first set of analysis results are printed and displayed, a menu is shown with the following possible selections:

11.2.1 Exit Program

Choose this option to exit from the program.

11.2.2 Change and Recompute

Select this item if you wish to change one or more of the parameters and re-do the calculations. The currently displayed results will be erased, and they will be replaced by the new results as those are computed.

11.2.3 View Results

Select this item if you wish to view some of the analysis results that are currently being displayed. You may scroll around to view portions that are off-screen. When you are finished viewing, press "Esc" to return to this menu.

11.2.4 Print Results

Select this item if you wish to save all of the current analysis results in a file of your choosing. This file can be printed later. The file will contain all portions not currently visisble on the screen.

11.2.5 Graph Net Benefits

Select this item if you wish to see a graph of net benefits versus design hourly volume. The graph will show the benefits both when they are and are not discounted.

11.2.6 Graph Delay Reduction

Select this item if you wish to see a graph of delay reduction (in minutes/100 vehicles) versus the cost of providing the climbing lane (in dollars/100 vehicles).

The graph will show the effects of providing a climbing lane for different traffic volumes.

11.2.7 Graph Accident Reduction

Select this item if you wish to see a graph of accident reduction (in accidents/year) versus the cost of providing the climbing lane (in dollars/100 vehicles).

The graph will show the effects of providing a climbing lane for different traffic volumes.

11.2.8 Graph Relative Effectiveness

Select this item if you wish to see a graph of relative effectiveness versus the cost of providing the climbing lane (in dollars/100 vehicles).

The graph will show the effects of providing a climbing lane for different traffic volumes.

11.2.9 Delay Reduction Weight

The value is a number in the range 0 to 1 specifying what relative weight should be given to delay reduction.

11.2.10 Accident Reduction Weight

The value is a number in the range 0 to 1 specifying what relative weight should be given to accident reduction.

11.2.11 Base Year

This is the base year for all cost figures. In other words, all costs are computed in the constant dollars of this base year.

11.2.12 Real Rate of Return

This is the real rate of return, in percent, to use when the benefit figures are discounted.

11.2.13 Inflation Rate

This is the annula inflation rate, in percent, to assume when computing cost-benefit figures.

This value is currently not used, as all costs are espressed in constant dollars of the base year.

11.2.14 Facility Life

This is the normal lifetime of the facility (climbing lane), in years.

11.2.15 Vehicle Hour Cost

This is the average cost of delaying one vehicle for one hour. It is used to compute the benefits of delay reduction.

11.2.16 Vehicle Accident Cost

This is the average cost of an accident, and should include property damage and an allowance for fatalities, if desired. It is used to compute the benefit of reducing accidents.

11.2.17 Lane Unit Cost

This is the average total cost, in constant dollars of the base year, of constructing one kilometer of climbing lane.

11.2.18 Lane Fixed Cost

This is the fixed cost, in constant dollars of the base year, of constructing a climbing lane. Total cost is computed by multiplying the unit cost times the length of the lane, and adding this fixed cost.

This value is often 0 (zero) if these costs are rolled in with the average unit cost.

11.2.19 Maintenance Cost

This is the additional cost, in constant dollars of the base year, of maintaining the climbing lane for one year. This is the cost over and above the normal maintenance cost (without climbing lane).

11.2.20 Results of Analysis

You are viewing the results of the cost-benefit and effectiveness analyses. You may use the normal scrolling keys to view other parts, and may use the "F10" menu to save these results to a file for later printing.

Press "Esc" or "Enter" to signal that you are done viewing, and wish to return to the menu.

Press "Alt-F1" for more information about which keys perform which functions.

Some common abbreviations in the results display:
DHV – Design Hourly Volume.
AADT – Average Annual Daily Traffic.
Delay Red. – Delay reduction.
Acc. Red. – Accident reduction.
DR Benefits – Benefits due to delay reduction.
AR Benefits – Benefits due to accident reduction.

12 Limits on Data Values

12.1 Data Limits

This section describes the limits placed on the various input data. Exceeding those limits during input will result in a message of some type being displayed.

There are three classes of limits; "warning", "soft" and "hard", each with a low and high limit. If a numerical value is outside of the warning limits, a simple warning message is displayed in the status line and the user need not change anything. If a numerical value is outside of the soft limits, a user must confirm that the value really is O.K. Numerical values are not allowed to be outside the hard limits.

For any given input variable, none, all, or any combination of the six limits (low and high for three classes) may be in force.

12.1.1 Distances and Grades

There must be at least two distances set. The first distance is typically "0" and gives the distance from the origin to the start of the site, which is also the start of a section of constant grade. Each distance thereafter is the distance from the origin to the end of a section of constant grade.

The grade values specify the average grades between 2 successive distances, and thus there must be exactly one more distance given than grades specified.

Grades are limited to fall within the range of -7% to +7% inclusive. In addition, some tables needed to compute certain quantities impose other limits on grades and length of grades combinations. The table of "E" coefficients (passenger-car equivalents of trucks on grades) impose the following maximum length of grades:

Grade	Max. Length
3	4.8 km
4	3.2 km

5	3.2 km
6	2.4 km
7	1.6 km

12.1.2 Percent No Passing Zones

The percent of no passing zones must be between 0 and 100 percent inclusive. It should normally be between 0 and 80 percent.

12.1.3 DHV Percent of AADT

The percent that the Design Hourly Volume is of the Average Annual Daily Traffic must be between 1% and 100%, but is normally between 10% and 30%.

12.1.4 Design Hourly Volume

The design hourly volume must be greater than 0, and is normally between 100 and 2000 vehicles per hour.

12.1.5 Percent Upgrade

The percent of upgrade traffic must be between 0% and 100%, and is normally between 25% and 75%.

12.1.6 Percent Trucks

The percent of trucks in the traffic stream must be between 0% and 100%, and is normally less than 50%.

12.1.7 Percent RVs

The percent of Recreational Vehicles in the traffic stream must be between 0% and 100% and is normally less than 50%.

12.1.8 Percent Trucks and RV's

The percent of trucks plus percent of recreational vehicles in the traffic stream must be between 0% and 100%. The sum is normally less than 50%.

12.1.9 Peak Hourly Factor

The Peak Hourly Factor must be between 0.01 and 10.0, and is normally between 0.25 and 4.0. It is usually 1.0.

12.1.10 Lane Starting Distance

The passing lane must start at or after the first distance shown in the list of distances (normally 0.0), and before the last distance shown in that list. In other words, the lane must start within the defined roadway site.

12.1.11 Lane Ending Distance

The length of the passing lane is the difference between the start and end distances. That length must be greater than the minimum specified in the configuration file (normally 1500m), and can be as long as you wish, though you will be asked to confirm lengths over 5000m.

12.1.12 Highway Design Speed

The highway design speed must be greater than 0, and can be as high as you wish. You will be asked to confirm values outside the range of 80 to 120 km/h.

The design speed is only used to determine the average approach speed for different levels of service at the approach, and then it only matters whether the design speed is less than 100 km/h or not.

12.1.13 Delay Reduction Weight

The Delay Reduction wieght must be between 0 and 1 inclusive. In addition, the delay reduction and accident reduction wieghts must sum to 1.0.

12.1.14 Accident Reduction Weight

The accident reduction weight must be between 0 and 1, inclusive. In addition, the delay reduction and accident reduction wieghts must sum to 1.0.

12.1.15 Base Year

The base year must be between 1989 and 2019, inclusive.

12.1.16 Real Rate of Return

The real rate of return must be between 0 and 100%, inclusive. It is normally between 3 and 15%.

12.1.17 Inflation Rate

The inflation rate must be between 0 and 15%, inclusive.

12.1.18 Facility Life

The facility life must be between 1 and 1000 yrs, inclusive, and should normally be between 15 and 50 yrs.

12.1.19 Vehicle Hour Cost

The vehicle hour cost must be between 0 and 100$/hr, inclusive, and should normally be between 3 and 15$/hr.

12.1.20 Vehicle Acc. Cost

The vehicle accident cost must be between 0 and 100,000$, inclusive, and should normally be between 1000 and 50,000$.

12.1.21 Lane Unit Cost

The lane unit cost must be between 0 and 1,000,000$/km, inclusive, and should normally be between 300,000 and 600,000$/km.

12.1.22 Lane Fixed Cost

The lane fixed cost must be between 0 and 1,000,000$, inclusive, and should normally be between 0 and 600,000$.

12.1.23 Maintenance Cost

The lane maintenance cost must be between 0 and 300,000$/km/yr, and should normally be between 0 and 50,000$/km/yr.

Part III

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